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REPORTING OF INDUSTRIAL ACCIDENTS.

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In the United States we have been very careless of human life. We regarded with horror the death-roll of a destructive earthquake in Italy, but a single disease claims a larger number of victims in this country every year, most of whom might be saved. The Civil War was a terrible conflict but its destruction of human life was insignificant when compared with the killed and injured in modern industry, where, according to the estimate made by Frederick L. Hoffman for 1908, from 30,000 to 35,000 suffer fatal injury and 2,000,000 more are non-fatally injured every year.* Modern industrial prosperity has been achieved at the expense of human life and human development, to far too large a degree; but policies of conservation of human powers and energies are rapidly taking the place of the reckless disregard of the nation's vital forces. The public health movement is making swift progress under the strong impelling force of public opinion. Disease and injury are being prevented and society, so far as it cannot prevent accidents, is devising means to diffuse the risks of industry and lift the burdens too long carried by those least able to bear them.

State legislatures have been unusually active within the past two years in legislating upon employers' liability and in authorizing special commissions to investigate industrial accidents and their results with a view to the formulation of plans of compensation and insurance. At least thirteen states have actually enacted schemes and several other states have the matter under consideration. Large has been the fund of information gathered and analyzed by these state commis-

*U. S. Bureau of Labor, Bulletin No. 78, p. 458.

sions. At the same time the lack of complete statistics of accidents has been emphasized. It is recognized that wise legislation for the future is conditioned upon increasing completeness of information. It is the object of this paper to show what sort of data concerning industrial accidents are being collected by the various states; to suggest some of the purposes for which such data are essential, and to estimate how well the present facts meet our needs. From such a discussion it is hoped will result a clearer understanding of what facts ought to be collected in the future and how they ought to be gathered and presented.

The Gathering of Accident Statistics by State Bureaus.

The desire for more complete information upon labor matters, with a view to the more just treatment of workers, gave rise to state bureaus of labor, established first in Massachusetts and at present found in more than thirty states of the Union. These offices have investigated a great variety of problems and have been assigned a wide range of duties. They have published the results of investigations relative to almost every condition surrounding the workingman at his work and in his home. Thus, have the bureaus become educational forces in the community, and, where efficiently managed, they have gathered and have classified materials upon the basis of which wise community action has been made possible. They have hastened remedial legislation and practical reforms in respect to employers' liability, regulating hours of labor, providing for the inspection of factories and mines, protecting the health and welfare of workmen, restricting the employment of women and children, establishing free employment bureaus, providing for the arbitration of labor disputes, and in relation to many other matters of vital concern to the working classes.

When Massachusetts passed the first 10-hour law in the country in 1874, the manufacturers of the state cried out against the alleged injustice because, as they maintained, it created unequal conditions of competition between themselves and their rivals in other states—a claim long familiar from

frequent repetition in connection with reforms advocated since that date in other commonwealths. The legislature directed the Massachusetts Bureau of Labor to investigate the facts of the claim. The result showed that under the operation of the new law the manufacturers of the state produced more goods per individual and per machine, and that the operatives in every respect were under better conditions than were those of surrounding states. This report put an end to serious attempts to repeal the 10-hour law.*

In 1904 the United States Bureau of Labor, in Bulletin 54, published a list of subjects of most vital interest to the laboring classes, which had been investigated by state bureaus of labor, and tabulated the number of state reports in which investigations on each topic had been found. Ten or more states had given attention to each of the following subjects—wages, hours of labor, strikes and lockouts, labor organizations, and relations between capital and labor. Only four states, up to that time, had attempted to collect data on industrial accidents. Since 1904 interest in the nature, extent, causes, and results of accidents has steadily increased. State departments of factory inspection and mine inspection have been created in many states in response to the demand for more careful supervision of working conditions by the state. Railroad and public service commissions are requiring reports of injuries occurring in connection with transportation. We are pausing to count the cost in human life of our phenominal industrial progress, and to formulate policies which regard man as of more importance than wealth, where the two interests come into conflict.

Of the more than 30 states having bureaus of labor and statistics at least 21 are annually collecting, with varying degrees of completeness, statistics of industrial accidents. Some collect regularly, as required by law, only the record of injuries in mines; others only the record of injuries received in factories; and most states fail to collect for all industries.

The following composite tabulation for 19 states † will

* U. S. Bureau of Labor Bulletin, No. 54, p. 1090.

† Nineteen states were tabulated, viz.: Conn., Ia., Ill., Kan., Mass., Me., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.

show the nature of the inquiries made as to accidents in the various states and the points emphasized by the largest number of states. These facts have been ascertained, for the most part, by direct correspondence, and from an examination of the report blanks and the annual reports of the various state bureaus.

I. Facts as to the Employer.

1. Name (Conn., Ill., Kan., Me., Mass., Mich., Minn., Mo., N. J., N. Y., Ohio, Okla., Pa., Wash., Wis., W. Va.)
2. Address (Conn., Ill., Kan., Me., Mass., Mich., Minn., Mo., N. J., N. Y., Ohio, Okla., Pa., Wash., Wis., W. Va.)
3. Location of plant (Ill., Me., Mass., Minn., Mo., N. Y., N. J., Ohio, Okla., Pa., Wash., Wis., W. Va.)
4. Nature of business or industry (Conn., Ill., Me., Mass., Minn., Mo., N. J., N. Y., Ohio, Okla., Wash., Wis., W. Va.)
5. Number of employees (Mass.)
6. Name and address of manager in charge (Kan., Mo.)
7. Who was in charge where accident occurred? (Kan., Wash.)

II. Facts About the Employee Injured.

1. Name (Conn., Ill., Ia., Kan., Me., Mass., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.)
2. Address (Conn., Ill., Kan., Me., Mass., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Wash., Wis.)
3. Age (Ia., Ill., Me., Mass., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.)
4. Sex (Ia., Ill., Kan., Me., Mass., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Wash., Wis., W. Va.)
5. Conjugal condition (Ill., Me., Mass., Mich., Minn., Mo., N. J., Ohio, Pa., Wash., Wis., W. Va.)
6. Nationality (Ill., Me., Mich., Minn., N. J., Pa., Wis., W. Va.)
7. Understand English? (Wash., Wis., W. Va.)
8. In what language instructed? (Wis.)
9. Physical defects (eye or ear) (Wis.)
10. Was injured aware of danger? Instructions (Wash., Wis.)
11. Did injured make proper use of safety devices? (Wash., Wis.)
12. Occupation—Nature of work done (Ia., Ill., Kan., Me., Mass., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis., W. Va.)
13. How long in occupation? (Ill., Me., Mass., Minn., Ohio, Wash., W. Va.)
14. How long in establishment? (Mass., Ohio, W. Va.)
15. How long at work with or at the thing causing accident? (Ill., Me., N. J., Ohio, Wash., Wis.)
16. Time or piece-worker (Wash., Wis.)

17. Wages per day or week (Me., Mass., Minn., N. J., N. Y., Okla., Wash., Wis.)
18. Was injured insured? (Mo.)
19. Personal habits (W. Va.)

III. Machine or Thing Causing the Accident.

1. What caused accident? (Conn., Ia., Ill., Kan., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Pa., Wash., Wis.,W. Va.)
2. Name of machine or part causing accident (Conn., Ill., Kan., Mass., Mich., Minn., Mo., N. J., N. Y., Okla., Ohio, Wash., Wis., W. Va.)
3. In whose control at time of accident? (Wis.)
4. Was thing guarded at the time—if not, why? (Me., Mich., N. J., N. Y., Ohio, Okla., Wis.)
5. Describe guard or safety device (N. J., N. Y., Okla., Wis.)
6. How did the accident occur? (Kan., Mass., Minn., Mo., N. Y., Pa., Wash., Wis., W. Va.)
7. Suggestions to prevent similar accidents (Kan., Me., N. J., Wis.)
8. Have you taken precaution against repetition? (Ia., Kan., Me.)
9. Has any accident occurred under similar circumstances, at same place, or with same apparatus? (N. J.)

IV. Resfonsibility for Accident.

1. Fault of employer, agent or machinery (Kan., Me., Minn., Neb., Ore., Wash.)
2. Wilful misconduct of injured (Me., Minn., Neb., Ore., Wash., Wis.)
3. Contributory negligence of injured (Kan., Me., Mich., Minn., Neb., Wash.)
4. Negligence of fellow-servant (Kan., Me., Minn., Neb., Wash.)
5. Natural hazard of industry (Me., Minn.)
6. Was safety device removed? By whom? (Wash.)
7. Names and addresses of witnesses to accident (Wash., W. Va.)

V. Time and Conditions of Accident.

1. Date, month and day (Conn., Ia., Ill., Kan., Me., Mass., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Ore., Wash., Wis., W. Va.)
2. Day of week (Kan., Neb., Ore., Wis.)
3. Hour of day (Conn., Ill., Kan., Me., Mass., Mich., Minn., N. Y., Ohio, Okla., Wash., Wis., W. Va.)
4. Hours of work before accident (Kan., Me., Neb., Ohio, Wis.)
5. Near window (Wis.)
6. Near artificial light (Wis.)
7. Condition of lighting (Wis.)
8. Crowding of workers on floor space (Wis.)

VI. Nature and Extent of Injury.

1. Exact nature of accident (Conn., Ia., Ill., Kan., Me., Mass., Mich., Minn., Mo., Neb., N. J., N. Y., Ohio, Okla., Wash., Wis., W. Va.)
   (a) Fatal, serious, severe, slight (Kan., Mich., Minn., N. J., Wis.) (All distinguish between fatal and non-fatal)
   (b) Internal (Minn.)
   (c) Loss of hands, feet, eyes, limbs (Minn.)
   (d) Sprains, dislocations, fractures, broken bones (Minn.)
   (e) Lacerations, bruises, cuts, burns (Minn.)
2. Attending physicians. Names—Addresses (Minn., Mo., Wash., Wis.)
3. Has injured resumed work? What date? (Ill., Me., Mass., Minn., N. Y., Okla.)
4. Probable period of disability (Ill., Me., Mass., Mich., Neb., N. Y., Okla., Wash., Wis., W. Va.)
5. Caused permanent total disability (Kan., Mass., Minn., N. J.)
6. Caused permanent partial disability (Kan., Mass., Minn., N. J.)
7. Caused temporary disability (Kan., Mass., Minn., N. J.)
8. Loss of time in working days (Ill., Me., Mich., Mo.)
9. Loss in wages (Me., Ohio)
10. Dependents. Names—Ages—Relationship—Address—Earnings (Ill., Me., Mass., Minn., Mo., Ohio, Wash., Wis., W. Va.)

VII. Care of Injured.

1. Medical and surgical attention since accident (Wis.)
2. Where was injured sent? (Mo., Okla., Wash.)

(Of course, employers' liability commissions require more details bearing upon compensation.)

From the table it will be observed that the states which collect accident statistics are unanimous in respect to one inquiry only—the name of the injured. All except one state require the date of the accident, and all except two states inquire as to the age and exact occupation of the injured, as well as the causes and nature of the injury. In addition to these questions, two thirds of the states seek information as to the name, address, location of the plant, and nature of the business of the employer; the address, sex, and conjugal condition of the injured; the name of the machine or part causing the accident, and the hour of day at which the accident occurred. Only one fourth of the states ask about the number of hours employed on the day of the accident. Somewhat

less than one half the states attempt to ascertain the nationality of the injured, how long they have been in the occupation, and how long at the particular operation causing the injury before the accident. But only three of the states inquire as to whether the injured understood English. About one third of the states inquire about the guarding of the thing causing injury and as to whether the employer admits that the accident was due to his fault or that of his agent, or whether he claims that it was due to the wilful misconduct or contributory negligence of the injured, or to the negligence of a fellow-servant. But only four states ask the employer to describe the safety devices or to make suggestions as to the prevention of future similar accidents. About one half the states inquire as to the probable period of disability, the average wage of the injured, and the details as to the number of dependents, while four states ask as to the loss of time in days and two the loss in wages, and four states attempt to define the extent of the disability, whether it is permanent or temporary, total or partial. Only one state asks as to physical defects of eye or ear which might have caused the accident, or as to the personal habits of the injured. The inquiries do not emphasize enough the person injured as to his liability to injury through his habits, his physical defects, his inability to understand English, his attitude toward safety devices, etc. Only two states ask for the names and addresses of witnesses to the accident and four require the names of the attending physicians. Only one state attempts in its schedules of inquiry to classify injuries in detail. Usually this is left to the one who tabulates the results. This analysis reveals a great variety of topics upon which information is sought but there is a great variety of combinations among the various states with far too little uniformity or agreement on the essentials. In order to agree on the essentials in such an inquiry there must be discussion and agreement upon the sort of problems, in the solution of which statistics may be useful. The latter part of this paper will be devoted to a discussion of some of those problems.

THE METHOD OF SECURING REPORTS AND THEIR SCOPE.

Having examined the nature of the inquiries actually made by the state bureaus in reference to accidents, certain further questions suggest themselves. Who fills out the report of accidents, the employer or an inspector? To whom is the report sent? Does it cover all industries or only a part? Are all accidents included or only those of a certain degree of seriousness, and is this specification the same for the various states? Is there a penalty for failure to report and how soon must the report be rendered?

There are two methods of making inquiries in an investigation: (a) by correspondence, mailing printed schedules to be filled out by a responsible person, and (b) personal inquiry by an officer or special agent. In accident reporting, as in most of the work of state labor bureaus, the former method is usually employed because of the expense attaching to the other method.

In the majority of cases the employer, or some one under his direction, fills out the schedules. In case any questions are not satisfactorily answered the blank is returned for further information, or an inspector of the State Department of Labor may be sent to investigate. When penalties have been imposed by statute for failure to report accidents it has resulted in substantial increases in the number reported, but it is more than likely that many accidents are not reported even in those occupations where the law requires reports, to say nothing of the many occupations, more or less dangerous, which are not required to report. In Wisconsin it is made the duty of physicians to report all accidents which occasion a disability of two weeks or more. The annual report for 1909–10 questions the completeness of these reports. The fact is cited that at least 50 fatal accidents were noted in a Milwaukee paper in one year which were not reported by physicians.* In Belgium physicians must report under penalty all accident cases treated, and the injured may not receive compensation until the physician has testified. This law has secured a more nearly complete record of accidents. A

* Fourteenth Biennial Report 1909–10, pp. 72–73.

similar plan should be adopted in our states, putting accidents on the same plane as certain diseases, especially in those states which have adopted insurance or compensation schemes. There will probably be far less difficulty in securing complete accident returns in the states which have these compensation schemes in operation. Private insurance companies possess a large fund of information concerning diseases and accidents. The state can greatly increase this kind of information and make it available for statistical purposes.

Besides the difficulties which arise from negligence or unwillingness to report injuries, there is more or less confusion among the states as to what department or bureau receives the reports. In some states the accidents in mines are reported to a separate bureau of mines; the accidents in factories to the department of factory inspection; the accidents on railroads to the railroad commission or public service commission; and the report of the department of labor attempts to combine all the data in its annual report. Sometimes the law requires duplicate reports to both the special bureau and the labor department.

The law in Illinois originally required that all employers report accidents causing death or 30 days loss of time to the Bureau of Labor. A later act, in 1910, required the report to the chief factory inspector from all employers under his jurisdiction, covering accidents causing 15 days loss of time. This later act practically repealed the part of the general act referring to factories. The chief factory inspector turns over his reports to the Bureau of Labor for tabulation and report. But this leaves part of the non-fatal accidents in Illinois collected on a basis of 30 days loss of time and part on a basis of 15 days loss of time. The result of this irregularity showed at once in the increase of accidents for the first year following the new method of reporting. The law further requires a report of accidents in mines to the mine inspectors, as well as to the labor department. A discrepancy occurs in the figures of the two departments.* Furthermore, the forms of report are not the same for both bureaus.

* Fourth Annual Report of the Illinois Bureau of Labor Statistics, pp. 7–8.

The New York Commission on Employers' Liability, in its second report, finds that it is impossible to state accurately the number of accidents reported in 1910, because each of the three offices receiving reports—the labor department, the public service commission of the first district, and that of the second district—has a different system of compiling statistics.*

In New Jersey the bureau of labor statistics, which does such excellent work in wage statistics, reports confusion in the records of accidents. The factory laws of the state require all factory owners to report accidents of a serious character to the factory inspection department. Only factory occupations and bakeries are included under this law. The Labor Department knows nothing of the observance of the law since no report has been made on the subject. In 1911 the legislature required all employers to report accidents to the commission on Employers' Liability, but the law also provides that these reports shall neither be published nor open to public inspection. The Labor Bureau itself collects reports of accidents from newspaper accounts and publishes these results as a part of its annual report. The Bureau has so improved this system that it feels safe in saying that 95 per cent. of the major accidents are traced, but this method cannot cover the important details of each injury, not to mention the minor accidents about which nothing is learned. But the Labor Bureau declares that the newspaper files are its only available source and it makes the best possible use of them.

Washington State has no law requiring employers to report accidents to the Labor Bureau. Each factory inspector is required to investigate and report to the labor office the facts as to accidents. Besides, the new state industrial insurance commission requires employers to report all accidents to it under penalty. That this situation is not satisfactory is evidenced by the seventh Biennial Report of the Bureau of Labor Statistics which declares, "The existing law for securing reports of accidents in mills and other industrial establishments is highly unsatisfactory and has failed almost entirely of accomplishing the purpose for which it was enacted. To be made properly effective, detailed reports of all accidents should be made to

* New York Employers' Liability Commission, Second Report, Note p. 2.

this bureau, immediately after their occurrence, and while the facts are fresh in the minds of the parties concerned." * Enough has been said on this point to indicate the desirability of having one state bureau a clearing house and place of record for all data on accidents.

A most serious criticism against our accident statistics lies in the fact that they do not cover all dangerous occupations. The great industrial state of Pennsylvania has no adequate system of reporting accidents except in the one important industry of coal mining. The Bureau of Industrial Statistics receives some data on accidents but there is no legal compulsion and the particulars are not given in detail even when reported. The Bureau is hoping for larger authority in the future. The fatal and non-fatal mining accidents are reported to a separate department of mines by inspectors and a separate report is issued.

In New York State the law of 1910 extended the list of occupations in which accidents must be reported to include "building, construction, excavating, and engineering work." During the first four months of its operation 2,530 accidents were reported, 75 of which were fatal. But this still does not include several more or less dangerous occupations, such as agriculture, water transportation, teaming, and stevedoring. In the Liability Commission's first report, page 28, it was estimated, after a careful examination of the cards of coroners' inquests and the records of emergency hospitals, that not more than half of the accidents of employment were at that time reported to any state department.†

Many other states require only part of the occupations to report accidents, but the states having liability commissions are requiring more complete records and we may expect, as more states adopt compensation laws, that the completeness of accident records will increase.

Somewhat more than one half the states requiring reports do not call for the return of all accidents in the given occupation but only those of a certain degree of seriousness. This degree of seriousness varies in the different states, from two

* Seventh Biennial Report of the Bureau of Labor Statistics and Factory Inspection, 1909–10, pp. 10, 11.
† New York Employers' Liability Commission, Second Report, Note p. 2.

days or more loss of time, in Ohio, to 30 days loss of time, in Illinois. Three states have one week as the limit, one state has two weeks, and still another has 15 days for part of the accidents and 30 days for part. This variability destroys the value of the statistics for purposes of comparison.

Most of the states fix a time limit within which report must be made and prescribe a penalty of fine for failure to report. The period varies among the states from immediate to annual report. Two states require report at once, one within 24 hours, two within two days, one within three days, one within five days, one within eight days, one within 10 days, one within 15 days, and two within 30 days. A standardization of this period would be desirable since the accuracy with which certain questions could be answered varies with the time elapsing after the accident.

In concluding this part of our discussion it may be said that statistics are of most value when compiled and tabulated in such a manner as to be comparable over a period of years as well as at the particular period. It is certainly desirable to have the work of mine inspection and factory inspection delegated to bureaus of experts, but the records of accidents should be sent to one central office, on forms drawn up with as much uniformity as the nature of the occupations will permit, and tabulated from year to year according to the same general scheme.

For many states, which have not yet adopted compensation schemes, some method of securing more complete returns is especially needed. The accident and occupational-disease problem is one in which the local health and philanthropic agencies are vitally concerned, because upon these agencies falls the responsibility for taking care of the serious results of accidents. From the point of view of uniformity of results it is desirable to keep the gathering of accident statistics and the enforcement of law under the control of a state department, but from the point of view of direct and vital interest in the problem of accidents more responsibility ought to be placed upon the local health authorities. Accident disasters always stir up intense local feeling, but the great need is for more continuous local interest in building up a fund of infor-

mation which will show what the constant human costs in industry are and how present laws are affecting the situation. State labor bureaus ought to be able to co-operate with the local health authorities in securing reports of accidents and occupational diseases. A local clipping bureau, in certain industrial communities, supported jointly by local and state departments, could be used as a check upon the completeness of accident reports and thus secure better enforcement of the law. The local charitable agencies, likewise, could do much in securing prompt report of injuries. It would mean more liberal appropriations by the state for the protection of its working classes, but the expenditures of the local authorities, would most surely be returned many-fold in the decreasing public burden as a result of accident prevention and by the hastened formulation of adequate plans for meeting the burdens due to accidents.

Problems in Accident Statistics.

1. *The Relation of Fatigue to Accidents.* Careful record of certain kinds of data should throw light upon this important problem. Exact knowledge concerning the nature of the business, whether seasonal or not, the hours of work, and speed of operation; as to the age, sex and experience of the worker; and as to the hours of the day, the day of the week, and the number of hours worked on the day of the accident is needed in order to form anything like correct conclusions concerning the influence of fatigue upon accidents. It is not enough to know the hour of injury without also knowing how many hours the person had been at work, because the working day does not begin at the same hour for all and the important fact relating to fatigue is the number of hours worked. But only one fourth of the states require this information. Only one third of the states seek information as to the experience of the worker, and none of them have attempted to record information as to the speed of operation at various periods of the day or the year. Yet, obviously, if we would draw accurate conclusions as to the effect of fatigue, we must have exact information on the other possible hypotheses to account for accidents.

Many statements are being made as to the influence of fatigue. At a recent meeting of the New York Academy of Medicine, held January 4th, Dr. Frederick L. Lee, in a discussion of a paper on occupational diseases, described the effect of fatigue upon the susceptibility to disease. He further declared that there was no doubt of the conclusion that many more accidents occur in factories and in occupations where the workmen are overworked and tired.*

The report of the New York Liability Commission declares that it was the common opinion of witnesses, although they had no figures to prove it, that excessive hours increase the number of accidents due to inattention on the part of the workmen in continuous industries like paper and pulp, and steel, where a two-shift system prevails.† Special investigations, such as are described in the report of the United States Commissioner of Labor on the strike at the Bethlehem Steel Works, published in 1910, give definite information concerning the long hours of labor. Of the 9,184 employees on the pay roll, 51 per cent. were found to be employed in occupations regularly requiring 12 hours or more per day as the regular working day, and 29 per cent. worked regularly seven days per week.‡ But Pennsylvania does not collect a regular and careful record of accidents in her great steel industry. It is, therefore, impossible to correlate accident statistics in Pennsylvania with long hours of work. It is left for special investigations such as the "Pittsburg Survey" to attack this problem. Usually, in our state reports, when the working day is discussed the average length of working day is given. We need more exact information upon the percentage of employees who work a given number of hours per day if we wish to throw light upon the relation of long hours to accidents.

The National Conservation Commission says, "The present working day from a psychological standpoint is too long, and keeps the majority of men and women in a continual state of over-fatigue . . . The manual worker through fatigue

* New York Times, Jan. 5, 1912.

† New York Employers' Liability Commission, Second Report, p. 22.

‡ Report of U. S. Bureau of Labor upon the Bethlehem Steel Strike, 1910, pp. 10-11.

caused by long hours is in a continual state of over-exertion."* Elizabeth Butler found in Pittsburg that many canning factories work at night until 10 o'clock during the busy season—a working week of 72 hours. One manager admitted that his girls worked 75 hours a week for two months every year. Miss Butler found in another factory, where foot-press work was the chief type of labor, that the workers were sometimes forced to work 12 to 14 hours and "accidents are so frequent that the place has been characterized as a butcher shop."† Miss Crystal Eastman quotes a yardmaster as follows: "Yardmen now usually work 12 hours, but when the yards are pressed, they often work the brakemen the 16-hour limit. And when a man works 16 hours at a stretch, it often means that he has been awake 18 or 20 hours, because there is a rule that a man must be called 2 1-2 hours before he goes on duty."‡

Thus, suggestive material is not lacking from special sources but there is a very serious lack of definite statistical information covering all the points which relate to fatigue as a cause of accidents among large numbers of employees in various industries.

The Hour of Day at Which the Accident Occurs.

For extensive data on this subject we must turn to foreign sources, but several of our states are now publishing material and special investigations are giving attention to the topic.

In the recent report of the Commissioner of Labor on the condition of women and child wage-earners, published as a Senate document in 19 volumes, one volume (XI) is devoted to the employment of women in the metal trades. A table on page 96 of this volume shows the tabulation, by hour of occurrence, of almost 15,000 accidents. Four sets of figures are used, collected by different agencies, in different parts of the United States, at different times, and covering different industries, each agency working independently. The results show a striking similarity and, in at least two particulars, a suggestive and rather unexpected distribution:—

* Quoted from *American Journal of Sociology*, Nov. 1911, p. 355.
† *Idem*, p. 356.
‡ *Idem*.

(a) The hourly proportion of accidents does not increase to the last hour of work, as the influence of fatigue might lead one to expect, but shows the greatest frequency about the middle of the working period.

(b) The proportion of accidents is generally greater for the morning than for the afternoon.

Every ten years, that is in 1887, 1897, and 1907, the German Imperial Insurance Office issues a special study of the facts regarding accidents compensated in the selected year. The last investigations, for 1907, are reviewed at length in Bulletin 92 of the United States Bureau of Labor. The results tabulated according to the hour of day agree in general with those just quoted from the report on the metal trades.*

However, it is not enough to record the hour of the accident. It is necessary to know also how long the worker was employed on the day of the accident. These figures few of our states require, and none of them have published. The German investigation does record this information, for 1907, in 79,791 accidents as follows:†

Length of Time Employed.	Per Cent.
Employed less than 1 hour	4.94
1 hour up to 2 hours	8.63
2 hours up to 3 hours	9.21
3 hours up to 4 hours	11.28
4 hours up to 5 hours	12.20
5 hours up to 6 hours	10.16
6 hours up to 7 hours	8.10
7 hours up to 8 hours	8.66
8 hours up to 9 hours	8.54
9 hours up to 10 hours	7.57
10 hours and over	10.71
	100.00

These figures corroborate the evidence from the data as to the hour of day. The expected increase in the proportion of accidents during the last hours of the day does not appear. The four last hours of work do not show a steady increase in accidents as the first five hours of the day do. The maximum for the day occurs at the end of the fifth hour of work.

Further evidence is contained in the first volume of the report on the condition of women and child wage-earners, describing accidents in the cotton mills as to the hour of occurrence.

* U. S. Bureau of Labor Bulletin, 92, table 6, pp. 29 *et seq.*

† *Idem*, p. 49.

The distribution is essentially the same as already noted.* The Minnesota figures for 1909–10 show a concentration of accidents in the morning at 10 and in the afternoon at 3 and a larger number in the morning.† The Wisconsin report for the same period shows a slightly later concentration in both morning and afternoon, but not enough different to change the significance of the figures already given.‡

From these facts it is apparent that the explanation of accidents is not simple,—that fatigue may be a very important cause but that other factors are of great importance and demand analysis. It would seem, since the largest number of accidents, according to all the tabulations, occur, not during the last working hours of the morning and afternoon, but at a considerable time before the noon hour and the closing hour, that speed is probably a very important factor. But we know very little about the speed at different seasons in specific trades, and we have still less statistical data on speed at various hours of the day. The accident rate per month would be useful if we could secure accurate returns concerning the number employed month by month, because it would indicate the effect of such seasons. At present, even if the records show a larger number of accidents at certain seasons, no definite conclusions can be drawn because larger numbers are employed at those seasons, and yet we do not know how many more are employed.

The German investigation previously cited tabulates the accidents according to the day of the week.§ Monday shows the largest proportion of accidents, decreasing until Thursday and rising again on Saturday to almost as high a point as Monday. The figures are given separately ‖ for Monday morning and Saturday afternoon in order to emphasize more strongly the concentration at the beginning and the end of the week. The editors of the German report suggest the hypothesis that the high rate for Monday is due to an ill-used Sunday holiday. This is of considerable interest to social

* Vol. I. p. 395.

† Twelfth Biennial Report, Minnesota Bureau of Labor, 1909–10, p. 137.

‡ Bureau of Labor Statistics of Wisconsin, 1909–10, p. 78.

§ U. S, Bureau of Labor, Bulletin 92, pp. 23 *et seq.*

‖ *Idem*, pp 29 *et seq.*

workers who are seeking to improve social and recreational opportunities for the working people, as well as to those interested in reducing accidents. Our states might easily extend their tabulations so as to include this information.

The previous discussion suggests that the explanation of accidents is not a simple task, and the examination of data bearing upon fatigue leads us further into other fruitful lines of inquiry. We ought not to be compelled to turn to foreign sources of information or to special studies over very limited areas for data concerning the fundamental facts concerning accidents which relate to this problem of fatigue. Many of our states are now striving to secure and keep on record the data needed as a basis for conclusions upon this subject.*

It can not be too strongly emphasized that the time at which accidents occur is of fundamental importance in understanding the problem. A very careful record of the time of day and of the number of hours worked before the accident occurred should be required by every state bureau charged with the collection of accident data. This information, to be most useful, must be gathered by industries and occupations, and a record made of the number employed at day and at night work in each employment. The numbers employed in a given industry by months is needed, in order to reveal seasonal changes and make possible the calculation of accident rates. From these data it will be possible to determine whether an accident in the given employment occurs in the course of the normal day's work or during overtime work; whether during the normal work season or during the rush season; whether at night or at day work. Besides, and of equal importance, it will be possible to calculate accident rates in the various employments for night and for day work, for rush seasons and for normal seasons, for the normal day and for the overtime working day. Then, if the various state bureaus will collect and publish these facts according to a uniform scheme, we shall be able to know the effect, in various states, of different regulations concerning the conditions of employment upon the accident rate.

* For a more detailed discussion of accident hours see *American Journal of Sociology*, Jan. 1912.—"The Relation of Fatigue to Industrial Accidents."—Part V, pp. 512 *et seq.*

2. *Experience of the Injured.* Data on this point should include a statement as to how long the injured person has been engaged in the particular occupation, in the particular establishment, and at the machine or operation by which he was injured. The hypothesis to be tested is that a certain time is needed to familiarize the worker with the details and secure for him the needed practice and correlation of movements, since each occupation and each establishment has special working conditions and special apparatus. Until this period has passed, he is more liable to accident.

Only one third of our states inquire as to the time at work in the occupation and with the specific machine or thing causing the accident, and only three states inquire how long the injured had been employed in the establishment. The German investigation for 1907 covers the facts as to length of time in the establishment and in the occupation.* The following table, for all industries, has been calculated from the German tabulations just cited, and shows the length of time in the occupation.†

Length of Time.	Total Number.	Average per Day.	Relative Number per Day.
Less than 3 days (excluding casual workers)	2,284	761.3	2,080.1
3 days and under 1 week (6 days)	1,050	350.0	956.3
1 week and under 1 month (26 days)	4,288	214.4	585.8
1 month and under 3 months (78 days)	5,960	114.6	313.1
3 months and under 6 months (156 days)	5,092	65.3	178.4
6 months and under 1 year (312 days)	5,705	36.6	100.0

The special report on the metal trades, just cited, tabulates the injuries to 1,102 press hands and to 1,603 workers in other occupations, as to the number of days employed at the particular machine before the accident. The following distribution is shown:—‡

* U. S. Bureau of Labor, Bulletin 92, pp. 47–48.

† Report on condition of women and child wage-earners in the United States, Vol. XI, Metal Trades. Footnote p. 92.

‡ Vol. XI, Metal Trades, p. 90.

AVERAGE NUMBER OF PRESS HANDS AND EMPLOYEES IN OTHER OCCUPATIONS INJURED PER DAY AFTER BEGINNING WORK ON MACHINE.

Duration of Experience.	Press hands.	Others.	All.
1st day	329.00	131.00	460.00
2d day to end of 1st week	46.00	37.00	83.00
2d week to end of 1st month	7.00	10.00	17.00
2d month to end of 6th month	1.49	3.69	4.00
7th month to end of 1st year	.47	1.32	1.57

Another table on page 91 of this same volume tabulates these same accidents according to the seriousness of the accident and the length of time employed at the machine. These two tables taken together suggest that not only do more accidents happen, at least in many occupations, to the less experienced during the first days of their work, but the nature of the accidents during these first days is more serious.

The Minnesota report for 1909–10 tabulates the accidents according to the length of time in the employment, with the following results:— *

Duration of Experience.	Total Accidents.	Average per Day.
1 week or less (6 days)	488	81.3
1 week to one month (26 days)	787	39.4
1 month to 6 months (156 days)	1,120	8.6
6 months to one year (312 days)	386	2.5

This table supports the evidence from the other tables and indicates the desirability of gathering such data more widely among our states, and of combining the material by trades in order to discover differences among the various occupations.

The wide collection of statistics as to the experience of the injured worker will throw light upon the current idea that the experienced worker has by his familiarity with the dangers of his employment become careless and especially liable to accident. The tables, just presented, do not support this conclusion. The whole question of the worker's negligence as a cause of accidents is illuminated by such data and there is no

* Twelfth Biennial Report, Minnesota, Bureau of Labor, 1909–10, p. 136.

good reason why we should not collect them more widely. The figures suggest that at the very point where the worker is giving the closest possible attention the number of accidents is greatest. The report on the metal trades discusses in some detail the conception of the carelessness of the worker. Is it carelessness when the worker, having so coördinated his movements as to do with greatest precision operations calling for simultaneous movements of two sets of muscles, *i. e.*, hand and foot in stamping work, suffers accident to his hand because something interferes with the hand movement and the foot action, nevertheless, takes place on exact time? Is not the perfection of his work dependent upon a great deal of automatic action in coördinating with precision two different movements, especially at the high speed required by his employer? Is not his safety also dependent upon this very fact as shown in the tables presented? The very thing that makes him safer if both movements work unhindered, and when both movements are performed exactly together, makes the worker unsafe if one of the movements is hindered, because the other movement follows on time with inevitable and cruel precision. This can scarcely be called carelessness.

It is not meant to imply that there is not much recklessness on the part of workmen constantly exposed to danger, but it is questionable whether this very lack of a consciousness of danger is not as often the cause of safety as of accident, especially under the conditions of speed and high tension in modern industry. It is maintained that the facts should be collected for each industry and tabulated separately in order to show the situation in each occupation, because in any movement for the prevention of accidents each occupation deserves to be treated according to its peculiar dangers and special problems.

3. *Nature and Duration of the Disability.* In order to understand the nature and extent of the burden imposed by accidents accurate information is necessary as to whether the accident resulted in temporary or permanent, partial or total disability; as to what loss of time and wages was involved, and as to the facts about those dependent upon the injured worker.

In order to apply the principles of insurance in meeting this burden, whether a plan be devised by the state, or by the employers in a particular industry, or by a single employer, exact information is needed in regard to the facts referred to, for all the workers suffering accidents. By application of the law of averages it will then be possible to create a fund sufficient to compensate those who suffer accident or their dependents. As long as there exists so little complete and accurate statistical data upon the number and consequences of industrial accidents, the cost of insurance or compensation schemes will remain a matter of conjecture.

The most recent scientific basis for a scheme of compensation has been worked out in the brewing industry. For almost two years a committee representing the Brewers' Association and the Union of Brewery Workers of America has been at work on this scheme of accident compensation and old-age pensions. As a basis for this plan, an investigation of the accidents in the brewing industry was considered imperative. Reports were received from 16,374 workmen concerning the details of accidents. Edward B. Phelps, of the American Underwriter, tabulated the results and formulated estimates as to the cost of the scheme based upon the facts of experience.* Under the terms of this plan a fund will be created, contributed to by both employer and employee, to compensate for accidents. But how large a fund would be needed, and therefore, what amount each should contribute could be decided only after the appeal to the statistical facts of past experience in that industry.

For no other large industry, except for interstate railroads, have the facts as to accidents been collected, irrespective of state lines.† Most of the large industries of the country are carried on in more than one state. If these states require reports as to accidents at all, there is little uniformity in the data reported. The results are not comparable and the entire burden of accidents in any large industry as a whole is unknown.

* The Survey, Jan. 20, 1912, pp. 1617 *et seq.* Report published by Edward B. Phelps separately.

† The author is informed that the United States Bureau of Labor, in connection with its investigation of the steel industry, has gathered data on accidents in that industry which may be published at a later date.

Only one fifth of the states, which require reports, make inquiry as to whether the disability is permanent or temporary, total or partial, and what loss in time is involved. About one half ask as to the probable period of disability.

The German special investigation for 1907 presents the details for accidents compensated in 1904 and follows the changes through four successive years in reference to these same cases.*

INDUSTRIAL ACCIDENT ASSOCIATIONS—1904, 65,205 CASES.

Year.	Per cent. of Injured Whose Injuries Resulted in:			
	Death.	Total Permanent Disability.	Partial Permanent Disability.	Temporary Disability.
1905	7.63	.93	44.27	47.17
1906	7.81	.80	41.12	50.27
1907	7.96	.78	39.00	52.26
1908	8.06	.81	37.40	53.73

This table is further elaborated under the heads of partial permanent disability and temporary disability to show, for each class, what proportion sustain no loss, under 25 per cent., 25 to 50 per cent., 50 to 75 per cent., and 75 to 100 per cent. in earning power. Detailed tabulation for each industry of these same facts is made. Such a record throws much light upon the nature and extent of the burden imposed by industrial accidents.

Obviously, the great need everywhere, and especially among our many state bureaus, is for a definition of these terms so that it will be clear where a given accident ought to be classified, and in order that the results from many states may be comparable, when, for instance, we wish to bring together the data for a great industry operating in several states. That this is one present difficulty with our statistics on this subject will appear from the material about to be presented.

* United States Bureau of Labor, Bulletin 92, pp. 70 *et seq.*

Year.	Total.	Per Cent. Deaths.	Injuries.		Per Cent. Temporary.
			Per Cent. Permanent.	Per Cent. Serious, Probably Permanent.	
1907	19,431	1.77	14.07	10.57	73.59
1908	14,455	1.77	12.10	11.41	74.72
1909	16,830	1.50	9.57	12.64	76.29
1910	25,390	1.39	8.00	9.79	80.82

The foregoing table of accidents reported to the New York Department of Labor are distributed, as to the seriousness of the injury, as follows:* These accidents are further analyzed by mechanical cause and degree of seriousness.† The above table, for all industries reporting accidents in New York State, indicates that to the increasing total of accidents the deaths and more serious injuries bear a decreasing proportion. The proportions vary among the different industries and this in itself is important information in formulating protective policies and in estimating the burden of accidents. Unlike the German tabulation, the table just presented does not analyze the degree of loss of earning power within the groups of permanent and temporary disabilities.

When we consult other state reports we find different methods used to present this same class of facts. The Wisconsin report for 1909–10 first analyzes the accidents according to whether the injury was fatal, permanent, or temporary, but does not follow the plan of the New York report in dividing the permanent into the definitely permanent and the serious and probably permanent. A second table distributes the accidents according to whether they were fatal, serious, severe, or slight, but does not distinguish between a serious permanent injury and a serious or severe temporary injury.‡ Thus, the difficulty with this presentation lies in the fact that the temporary and permanent injuries are not distributed according to their seriousness and effect upon earning power which is the matter of greatest importance. A slight injury

* New York Liability Commission—2d Report, p. 2, for basis of calculations used in this table.

† New York Liability Commission—2d Report, table opposite p. 2.

‡ Bureau of Labor Statistics of Wisconsin, 1909–10, pp. 75–76.

may be permanent in its effects upon earning power, or a severe injury may be temporary in its effects.

It is evident that there is no uniform definition of terms explaining the nature and duration of disability from accidents or its effect upon earning power. Nor is there a uniform method of presenting results so as to render them comparable.

Over half the states ask for the probable period of disability. These are predictions and are, therefore, very liable to error, especially where the employer fills out the report. Some states require a supplementary report at a later date to complete and correct this information. The Wisconsin report for 1909–10 distributes the accidents according to the probable period of disability, the reports having been sent in by physicians:— *

Duration.	Number.	Per Cent.†
Not over 2 weeks	1,618	32.4
Over 2 weeks, not over 1 month	2,129	42.6
Over 1 month, not over 2 months	749	14.9
Over 2 months, not over 3 months	180	3.6
Over 3 months, not over 6 months	85	1.7
Over 6 months	11	.2
Fatal	135	2.7
Not predicted	96	1.9
	5,003	100.0

It will be observed that about three quarters of the accidents are shown to involve a probable disability of less than one month. The Minnesota report for the same period tabulates the probable disability for specific kinds of injuries only.‡ The need is for a more uniform and definite meaning of terms in the schedule of inquiry and for some clearer understanding of the purposes of tabulation and a uniform method of presentation so as to render the results comparable.

4. *The Mechanical Cause of Accident and Nature of Injury by Industries.* From the point of view of the prevention of accidents it is very necessary to have exact information on these points. Most of the states require exact statements in

* Bureau of Labor Statistics of Wisconsin, 1909–10, p. 77.

† This percentage distribution is greatly affected by the exclusion of trivial accidents.

‡ Twelfth Biennial Report Minnesota Bureau of Labor, 1909–10, pp. 129 *et seq.*

detail, but the one who fills out the report states the facts in his own way, and it is left to the person who tabulates the results to classify them as best he can in preparing the annual report and in keeping the records. This accounts for the variety of classifications and tabulations in state reports.

The great need here is for some more uniform classification of the kinds of injury and the mechanical causes of injury for each industry in order that the facts collected in one state may readily be compared with those for another state and that the reports for successive years in the same state may be comparable. Just as the classification of the causes of death has been worked out according to which all deaths are grouped, from whatever community reported, so in each industry the employer or the physician ought to be able to classify the accidents reported according to a uniform grouping. Thus, a specific accident would mean the same from whatever shop or community reported. These classes of injuries and mechanical causes should be based upon past experience in recording accidents and always with a view to the practical purposes to be served by the results. At present only one state attempts to classify the nature of the injury in the report blank itself.

The New York Liability Commission, in its second report, opposite the second page, presented a cross-classification in detail, of cause and nature of injury, in the case of accidents reported in 1907–10. This table will illustrate the meaning of what has just been suggested. If this proves a good classification, then the form should be preserved from year to year and should be adopted in other reports. If it is not the most useful then it should be discarded in favor of a more useful classification. The contention is for some recognized standard form. The table is as follows, both parts belonging to the same table:—

Cause.	Grand Total.	Temporary.		Serious, Probably Permanent.	Deaths.
		Total.	Fractures.		
Mechanical power ..	33,990	21,415	845	5,301	565
Heat and electricity .	6,410	5,417	22	552	302
Fall of person.....	6,165	5,543	534	292	129
Injured by weights ..	16,969	14,963	729	1,099	145
Flying objects	3,088	2,502	8	424	1
Vehicles and animals.	1,390	1,197	86	119	15
Miscellaneous.....	8,094	7,420	115	429	49
Total.....	76,106	58,457	2,339	8,306	1,206

Cause.	Permanent Injuries.						
	Loss of One or More				Internal.	All Others.	Total.
	Limbs.	Hands or Feet.	Fingers.	Eyes.			
Mechanical power ..	153	155	5,337	62	147	765	6,619
Heat and electricity	5	5	7	49	9	64	139
Fall of person	3	...	17	4	72	105	201
Injured by weights	12	4	393	1	142	207	759
Flying objects	...	...	3	133	1	24	161
Vehicles and animals	2	2	24	...	11	20	59
Miscellaneous	1	...	95	5	24	71	196
Total.....	176	166	5,876	254	406	1,256	8,134

Each of these main causes is further subdivided in the extended table into detailed causes. For instance, Mechanical Power is subdivided into: (1) Transmission of power, (2) Conveying and hoisting machinery, (3) Woodworking machinery, (4) Paper and printing machinery, (5) Textile machinery, (6) Leather-working machinery, (7) Metal-working machinery, (8) Machinery for polishing, (9) Machinery used in bakeries, etc., and (10) Machines not elsewhere specified. These subgroups are each tabulated according to the cross-classification of the nature of the injury. Each main mechanical cause given in the table is subdivided in like manner.

The Wisconsin Report for 1909–10, pages 80–82, uses the same classification of mechanical causes in detail, but combines with these divisions in cross-classification the various industries instead of the kinds of injuries as the New York tables do. The Wisconsin Report thus secures a total under each industry for the various detailed causes, but not for each kind of injury.

The Minnesota Report for 1909–10 classifies the part of the body injured in a cross-classification with the nature of the injury (p. 127), and then classifies the nature of the injury by industries (p. 131), and finally, the mechanical causes in a cross-classification with the nature of the injury (p. 143). But the classification of mechanical causes here used is not the same as that used in the New York and Wisconsin reports. Furthermore, the headings describing the nature of the injury in the three tables (pp. 127, 131 and 143) in the Minnesota report itself are not exactly the same.

From the point of view of the enforcement of existing laws for the safety of employees exact information is desired about the particular shop or process; from the point of view of the enactment of new laws the important information should relate to certain trades or occupations or processes especially dangerous, concerning which the state may elaborate more specific safety provisions; and from the point of view of the conservation of the nation's working force the data from the various states should be comparable.

5. *Sex, Age, and Conjugal Condition of the Injured.* All except two of the states, requiring accident reports, ask as to the sex and age, and two thirds of them inquire as to the conjugal condition of the injured. It is important that the injured be classified by sex in certain occupations in order to throw light upon the problem of the protection of women workers and the regulation of their working hours. Of course, the absolute numbers of accidents among male and female employees mean nothing without taking into consideration the number of each sex employed and working out a rate of accidents. On this account there is need that a careful record of the number of employees in each establishment throughout the state, classified by age, sex, and conjugal condition, be kept in the labor office or in the bureau of state statistics. It would be desirable if this record of employees should be reported each month, in order that more exact information might be available concerning seasonal trades, unemployment, and accidents at certain rush seasons. It would then be possible to determine rates of accidents, by sex and age groups, for one shop singly, or for an entire indus-

try. In order to understand the relative danger of various operations within a shop or industry we should know the numbers employed at those processes as well as the absolute number of accidents.

The Wisconsin Report, for 1909–10, classifies accidents by sex as follows:—*

	Number Injured.	Per Cent.
Male	4,877	97.50
Female	124	2.47
Not stated	2	.03
	5,003	100.00

This table would mean much more if the number employed and the accidents, male and female, were stated by industries, and it would mean still more if these facts were stated by certain processes or operations within the industry. This would involve a uniform classification of processes or operations within an industry so that each employer would know how to classify his workers and the accidents occurring in connection with those processes.

The special investigation of the metal trades, previously cited, calculates accident rates for men and women in 16 establishments employing 21,069 workers.† Where an especially high rate was found it was traced to a particular process and there the source of danger could be located. When the occupations in which each sex is engaged are considered it is shown that the males are found in the more dangerous occupations. This special investigation showed generally a smaller accident rate for women than for men and where a higher rate in a particular establishment was observed it could be explained by the employment of women in large numbers upon stamping presses.‡

The age of the injured may affect the accident problem either from the point of view of liability to accident, or from the point of view of the results of the accident and the

* Bureau of Labor Statistics, 1909–10, p. 74.

† United States Bureau of Labor, Twenty-fourth Annual Report, Volume XI, Metal Trades, pp. 75–76.

‡ *Idem*, p. 77.

compensation needed to fairly meet the losses incurred. It may prove a factor to be taken along with inexperience as a cause of accidents. This view is not supported for the metal trades, where, according to the special investigation, page 93, the average age of males injured during the first day of experience, was shown to be even slightly higher than for those injured after longer experience.

If we are able to judge correctly the extent of the burden imposed by accidents, it is important to know at what time of life the rate is the highest. The Minnesota report for 1909–10 classifies 7,826 accidents by age groups:—*

Age.	Per Cent.
14 to 16	.89
17 to 21	16.24
22 to 30	44.54
31 to 40	23.00
41 to 50	10.63
51 to 60	3.90
60 and over	.80
	100.00

The most obvious criticism against this table is the sudden change in the age interval, 3 years, 5 years, 9 years and 10 years. The sudden change from 5 to 9 years in the third interval exaggerates the percentage of accidents occurring at that interval. In this choice of interval there should be uniformity in the length of the interval itself in order to render the per cents. comparable and to determine which age group suffers the largest percentage of accidents and how much larger. There should be uniformity in successive reports and among different states so as to render the data comparable.

Another important inadequacy lies in the fact that the numbers employed at each age group are not given. No accurate conclusions are possible as to the relative liability of various age groups to accident until we know the number employed at each age and calculate a rate of accidents upon that basis.

Such a table as the one just presented does show that 83.78 per cent. of accidents reported in Minnesota occurred between the ages of 17 and 40, which is in the prime of life, at the period of greatest earning power, and at the period when

* Twelfth Biennial Report, Minnesota Bureau of Labor, p. 133.

serious or permanent disability is likely to cause the heaviest burden in the support of dependents.

The Wisconsin report for 1909–10, page 75, classifies 4,851 accidents by age-groups and states the numbers employed at each age group, which allows the comparison of the number of accidents with the number employed. In this respect, it is an improvement over the table just given from the Minnesota report, but the age intervals of the Wisconsin table are not at all the same as for the Minnesota table and their length is not at all uniform The first interval is 5 years, the second 10 years, the third 15 years, and the fourth 20 years, which entirely distorts the percentages for purposes of comparison between age groups, as well as for comparison between the two states.

This classification of the injured by age groups would prove more suggestive if extended to particular industries, for instance, those industries which employ a large percentage of women or young persons, and to certain processes and operations recognized as especially dangerous. The presentation of convincing evidence upon the matter of accidents might result in revolutionizing the methods of introducing new workers into dangerous employments, not alone from motives of humanity but also from the motives of efficiency and self-interest on the part of the employer.

The conjugal condition of the injured is chiefly important in two directions. Classification by industry and conjugal condition might indicate whether marriage tends to make the worker more careful in his operations or more cautious in his choice of employment. To draw more accurate conclusions it would be necessary to know the conjugal condition of the workers as a whole in order to calculate rates of accidents for married and single in various establishments and occupations.

Of still greater practical importance is the relation of the injured worker's conjugal condition to the burden which accident brings and to the problem of the support of dependents. About half the states inquire as to the dependents of the injured and in the states with compensation schemes in operation this information can be secured more accurately. But in all the states it is desirable to collect such information in order to

better understand the results of accidents and the need of an adequate plan to meet fairly their consequences.

There remain many other problems of industrial accidents in the solution of which statistical data serve a useful purpose. A more careful inquiry is needed concerning the influence of nationality, physical defects, and personal habits upon liability to accident, and concerning the responsibility for accidents, whether due to the fault of employer or worker or due to the hazard of industry. Thus far in the discussion of accidents attention has been largely centered upon the large absolute numbers of injuries and their terrible consequences. This method has served and is serving a most useful purpose in rousing public opinion, but a careful and scientific knowledge of accidents involves the calculation of accident rates. Therefore, we must strive for the necessary data for the calculation of rates of accidents.

In the first part of this discussion we have reviewed the kind of inquiries made concerning industrial accidents in the various states and have noted how many states make each inquiry, with a view to showing the sort of information upon which most of the states agree, and with the further purpose of indicating the need for greater uniformity in schedules and for agreement on the essential facts required in reference to accidents. The method of collecting the information, and the scope of the inquiries show a serious lack of complete data and the lack of a uniform scheme of record and presentation. Much of our scanty material is not comparable from year to year or among the various states.

A clearer understanding of the nature of the problems, in the solution of which statistical data are essential, has been the aim of the second part of this paper. Such an understanding is preliminary to the collection of the facts themselves and should be our guide as to what facts to collect in the future and how to collect and arrange them.

THE COAL SUPPLIES AND COAL PRODUCTION OF THE UNITED STATES.*

By Edward W. Parker, *United States Geological Survey.*

The coal fields of the United States are scattered over thirty States and the Territory of Alaska. The total areas of the known coal fields aggregate 310,000 square miles. In addition to these known areas there are about 160,000 square miles which may contain workable coal, and about 32,000 square miles where coal probably exists, but is under cover so heavy that it may be considered unavailable as a present resource.

The estimates on which these figures are based have been made by geologists of the Federal Survey and are regarded as moderate. In fact, I have been informed that the later investigations of the coal fields of the Rocky Mountain region indicate that the area of those coal fields has been underestimated, so that the total of 500,000 square miles which we have been accustomed to consider the possible limit of our prospective coal-producing territory may be exceeded. With the exception of an insignificant amount produced in Colorado and New Mexico, all the anthracite mined in the United States is taken from a small area in the eastern half of Pennsylvania. The Pennsylvania anthracite region contains less than 500 square miles, and yet it had produced by the close of 1910 nearly 2,200,000,000 short tons of coal, or a little more than one fourth of the total coal output of the United States.

For convenience the bituminous coal areas of the United States have been divided into six main provinces: the Eastern, Interior, Great Plains, Rocky Mountain, Pacific Coast, and Gulf provinces. The Eastern Province includes all the bituminous areas of the Appalachian region and two outlying areas in Virginia and North Carolina. It contains 69,332

*Address delivered at the quarterly meeting of the American Statistical Association at Washington D. C., April 5, 1912.

square miles, and is by far the most productive of the coal fields. In 1910 it produced approximately 57 per cent. of the total output, and it has produced nearly one half of the entire coal output of the United States since mining began. The aggregate production of anthracite in Pennsylvania and of bituminous coal in the Appalachian region constitutes 75 per cent. of the total production of coal in the United States.

The anthracite region of Pennsylvania is estimated to have contained when mining began 21,000,000,000 short tons of coal, and the Appalachian region to have contained over 542,000,000,000 tons of bituminous coal. Twenty per cent. of the anthracite supply has been exhausted. The drain upon the bituminous areas of the Appalachian region has consumed about 1.2 per cent. of the original supply.

The Interior Province contains the coal areas in the Mississippi Valley and the somewhat isolated Michigan field, which lies in the drainage area of the Great Lakes. The Interior Province is considerably larger in area than the Appalachian, having a total of 113,744 square miles, but it will probably be many years before it reaches the productive importance shown by the Appalachian region at the present time. In 1910 it produced 96,500,000 short tons, or more than 18 per cent. of the total output of the country. From the earliest times to the close of 1910 this province has produced nearly 20 per cent. of this total.

The Rocky Mountain and Great Plains provinces possess enormous potentialities as coal-producing regions. The known coal areas embrace nearly 125,000 square miles, and these provinces also include most of the 160,000 square miles of little known regions which may contain workable coal, and the 32,000 square miles of coal under heavy cover. When all is known we shall probably find that these areas include over 300,000 square miles of coal-productive territory. The content of the present known fields is nearly 2,000,000,000,000 short tons, from which to the close of 1910 less than 350,000,000 tons had been withdrawn. The production in 1910 was 28,857,000 short tons, or a little over 5.5 per cent. of the total for the United States.

The Pacific Coast fields are comparatively small. Exclusive of those in Alaska, they have an aggregate area of about 1,830 square miles, and they are estimated to have contained, when mining began, 22,000,000,000 tons, or about the same as the anthracite region of Pennsylvania. The anthracite region, however, has produced over 2,000,000,000 tons, whereas the Pacific Coast States have produced only a little over 60,000,000 tons. Their production in 1910 was 3,992,000 short tons, nearly all of which was mined in the State of Washington.

The Gulf Province, which includes the lignite areas of Texas, Louisiana, southern Arkansas, Mississippi, and Alabama, is not now of much economic importance, although the production of lignite in Texas amounts to nearly 1,000,000 tons annually. As in the Rocky Mountain Province, these areas possess great possibilities for the future.

In the quality of its coals as well as in its present production, the Appalachian region is the most important. In that area are found the highest-grade coking, steaming, blacksmithing, gas, and domestic bituminous coals mined in the United States. Coking coals are found all the way from Pennsylvania to Alabama, and most of them occur along the eastern border.

The coals of the Interior Province are principally dry, noncoking coals, but make excellent steam and domestic fuels.

In the Great Plains region, particularly in North Dakota and South Dakota, as they approach the mountains, the coals grade from lignitic to subbituminous, or black lignite, and in the mountainous areas become true bituminous coals, some of which make excellent coke. The region also contains some anthracite. The principal coking operations in this region at present are in the Raton-Trinidad field, in the southeastern part of Colorado and the northeastern part of New Mexico. Coking coals are also found in Utah, Montana and Wyoming. Some of the coals in Washington make coke, and some natural coke has been found in that State.

The Royal Commission on the Coal Supplies of Great Britain estimated the reserves of that country at approxi-

mately 160,000,000,000 long tons, or say 180,000,000,000 short tons. In Continental Europe the supplies are as follows:

Germany	145,400,000,000 tons
Austria	17,000,000,000 tons
France	17,000,000,000 tons
Belgium	16,000,000,000 tons
Russia	20,000,000,000 tons

The known supplies of Canada are about 100,000,000,000 tons, and the supplies of the United States, including Alaska, are placed at 3,200,000,000,000 tons, or eight times that of all Europe.

The total production of coal in the United States to the close of 1910 has amounted to 8,243,350,000 tons. It has been estimated that for every ton of coal mined, one half a ton has been lost in the operation of mining. In the early days in the anthracite region (in fact, in all the coal-producing districts) this loss was much greater than it is at present, The total exhaustion has been estimated at about 13,400,000,000 short tons. The total exhaustion since mining began is less than one half of one per cent. of the original supply. The annual rate of exhaustion at the present time, as represented by the production of 1910, is 0.025 of one per cent. of the supply. The quantity of coal still in the ground at the close of 1910 was 6,000 times the production of that year, and if the loss in mining is estimated at half a ton for every ton mined, the supply is 4,000 times the exhaustion resulting from the tonnage extracted in 1910. This does not mean, however, that the supply will last 4,000 years. In fact, if the production continues to increase at the rate which has been maintained during the last fifty years, doubling practically every decade, very little arithmetic is necessary to show that the agitation regarding the conservation of our fuel supply has not been altogether without some ground.

A comparison of the increase in coal production with that of the growth of our population presents some interesting figures. In 1850, sixty years earlier than the latest year for which figures are available, the production of coal in the United States amounted to less than 6,445,681 tons. The

population in that year was 23,191,876 persons, and the production of coal per capita was 0.278 ton. Ten years later, in 1860, the population was 31,443,321 and the coal production amounted to 16,139,736 tons, or an average of 0.514 ton for each person. At the census of 1870 the population of the United States amounted to 38,558,371; the coal production of that year amounted to 36,806,560 short tons, a per capita average of 0.96 ton. Ten years later, in 1880, when the population was 50,189,209, the coal output amounted to 76,157,944 short tons, or 1.52 tons per capita. In 1890 the population had grown to 63,069,756, an increase of 25 per cent. over 1880, and the coal production had grown to 157,770,963 short tons, or a per capita production of 2.52 tons. At the taking of the Twelfth Census, in 1900, when the increase in population amounted to 22 per cent., the total number of persons reported being 76,303,387, more than 79 per cent. had been added to the coal production, with a total of 269,684,027 short tons, or an average of 3.53 tons for each inhabitant. In other words, while the population was increasing 230 per cent. from 1850 to 1900 the production of coal increased 4,084 per cent. The report of the Thirteenth Census on population shows that on April 15, 1910, the United States contained 91,972,266 persons. The coal production in that year was 501,500,000 short tons, indicating that the per capita coal production at the present time is about 5.5 short tons.

It is true that in the earlier years covered by this summary the proportion of wood used for fuel was larger than it is at the present time, but the actual consumption of wood for fuel today is probably as great as, or possibly greater than, it was half a century ago. It should also be remembered that, in addition to the production of coal, there has been a great increase in the use of oil for fuel, and natural gas still remains an important fuel. The consumption of petroleum for fuel in 1910 was probably equivalent to between 20,000,000 and 25,000,000 short tons of coal, about four times our production of coal sixty years ago.

The great increase in coal mining, particularly within the last thirty years, has been in the production of bituminous

coal, although the production of anthracite has kept abreast with the increase in the population of the districts served by it.

The strike in the anthracite region in 1902 and the industrial depression in bituminous coal production in 1908 made striking exceptions to an almost steady growth. The anthracite industry of Pennsylvania is not subject to fluctuations caused by industrial conditions as is the bituminous coal trade. Twenty-five years ago considerable quantities of anthracite were used in iron furnaces and for making steam; but it is now used almost entirely for domestic fuel. Only the sizes below pea coal, which are not fit for domestic use are used as steam fuels, and the consumption even of these is limited practically to the heating of office buildings, hotels, apartment houses, etc. The quantity of anthracite now used in any branch of manufactures is insignificant.

Pennsylvania, with its combined production of anthracite and bituminous coal, is far in the lead. Until within the last few years Pennsylvania produced more than one half of total output of coal in the United States, and at the present time contributes 47 per cent. of the total output. On account of the higher price of anthracite, as compared with bituminous coal, the value of Pennsylvania's production is within a small fraction of 50 per cent. of the value of the total production in the United States. Pennsylvania's production of bituminous coal in 1910 was 150,000,000 tons, and that of anthracite, 84,500,000 tons, but the value of the anthracite exceeded that of the bituminous production by over $7,000,000. West Virginia ranks second in total production, having supplanted Illinois in 1909. No better illustration of the unwisdom of the failure to utilize raw products at home can be shown than that presented by the comparison of West Virginia's production with that of Illinois. The bituminous coal fields of West Virginia contain some of the highest-grade steaming and coking coals in the United States, if not in the world, and yet, as will be seen, the average price for this product in 1910 was less than $1 per ton. The coals of Illinois, on a strictly B. T. U. basis, rank probably 20 per cent. lower than the average West Virginia coal, yet the average price for the

Illinois product in 1910 was $1.14 per ton, compared with 92 cents as the average price for West Virginia's production. Few realize that 80 per cent. of the value of the mineral production of West Virginia is represented by its fuel output, coal, petroleum, and natural gas, and fully 80 per cent. of all of these fuels of inestimable value is consumed outside the state. On the other hand, the production of Illinois is consumed principally in the manufacturing and transportation industries of that State, or in immediately adjacent territory. West Virginia, which ranks second in coal production, stands 34th among the states in the value of its manufactured products. Some of its valuable timber is shipped to Grand Rapids, Mich., and the manufactured furniture is shipped back into West Virginia. The transportation companies traversing West Virginia appear to be more interested in securing the heavy coal tonnage than in building up manufacturing industries in the State. Most of the coal consumption within West Virginia is by the locomotives carrying coal to the support of manufactures in other States. Agriculture seems to have been as much neglected as manufactures, for West Virginia imports from other States from $30,000,000 to $40,000,000 worth of agricultural products annually.

The value of the coal output of the United States is equal to nearly one third of that of the total mineral production of the country. In 1910 the total value of the mineral products of the United States was $2,003,744,869. The value of the coal produced was $629,557,021.

Next to coal in the value of the mineral products is pig iron, with a total value in 1910 of $425,115,235. These two, iron and coal, make up more than half the total value of the mineral output. The third in importance are the clay-working industries, which in 1910 contributed $170,115,974 to the total value. Copper comes fourth, with $137,180,257, and petroleum fifth, with $127,896,328. "The accursed thirst for gold" is responsible for less than 5 per cent. of the total value of our mineral production, the gold mines of this country yielding in 1910 a value of $96,269,100.

The total coal production of the world at the present time

amounts to 1,280,000,000 tons, of which the United States contributes about 40 per cent. Prior to 1899 the United States stood second among the coal-producing countries of the world, Great Britain leading. In 1910 the United States produced 501,596,378 short tons of coal, and exceeded by more than 50 per cent. the tonnage of Great Britain and all of her colonies.

An interesting fact with regard to the world's production of coal is that 98 per cent. of the total output is from the northern hemisphere, the total quantity of coal produced in the countries lying south of the equator being between 20,000,000 and 25,000,000 tons annually.

Men and machinery.—The coal mines of the United States gave employment in 1910 to 725,030 men, of whom 169,497 were employed in the anthracite mines of Pennsylvania, and 555,533 were employed in the bituminous and lignite mines. The anthracite workers averaged 229 days during the year, and the bituminous and lignite averaged 217 days, the general average being 220 days. The average production per man in the anthracite mines was 498 short tons for the year and 2.17 tons for each working day, and in the bituminous and lignite mines the average production per man was 751 tons for the year and 3.46 tons for each working day. The statistics of labor employed in 1909, which were collected by the Bureau of the Census, were not compiled in a manner that furnishes comparisons with the statistics compiled by the Geological Survey.

In 1908 there were 690,438 men employed, 174,174 in the anthracite mines and 516,264 in the bituminous and lignite mines. In that year the average production per man in the anthracite region was 478 tons for the year and 2.39 tons per day, and in the bituminous and lignite mines these averages were, respectively, 644 tons and 3.34 tons.

It is doubtful if the great tonnage record made in the production of bituminous coal by the United States in recent years could have been attained with the supply of labor available and at the low prices which have obtained except for the introduction of labor-saving machinery. In this the greatest part has been played by the machines used for

undercutting and shearing the coal. In many cases the installation of machinery has been forced upon the operators in order to meet the constantly increasing competition combined with advances in wages, and yet it also happens that much of the advantage sought to be obtained has been lost through the differentials in mining rates placed against the machines. More important than the lessening of the mining cost, however, is the reduction of liability to accident by decreasing the proportion of coal "shot from the solid." This reprehensible practice of making the powder do the work, in addition to increasing the danger from explosions and fires, weakens the roof and pillars and produces an inordinate quantity of undesirable or unmarketable fuel. Every step taken to eradicate this evil is a step in advance.

The total quantity of bituminous coal and lignite mined by the use of machines in 1910 was 174,012,293 short tons, or 41.7 per cent. of the total. In 1909 the machine-mined production amounted to 142,496,878 short tons, or 37.5 per cent. of the total output of bituminous coal and lignite. (None of the anthracite product is undercut either by hand or machinery. It is all shot from the solid, and the character of the coal does not permit of any other method.) The quantity of machine-mined coal in 1910 exceeded that of 1909 by 31,515,415 short tons, or 22.1 per cent., whereas the total production of bituminous coal and lignite showed an increase in 1910 over 1909 of only 9.84 per cent. Over 80 per cent. of the total increase in 1910 was in machine-mined coal. The number of machines in use did not show as large an increase as the increase in machine-mined coal, but the statistics indicate a decided advance in the efficiency of the machines employed, and this in turn is to some extent responsible for the increase in the output per man previously mentioned. There were 13,254 machines in use in 1910 against 13,049 in 1909. The average production for each machine increased from 10,920 short tons in 1909 to 13,127 short tons in 1910.

Washed coal.—The production of anthracite in Pennsylvania includes a considerable quantity of coal recovered from the old culm banks by washers. The production of 1910 includes 3,296,318 long tons of fuel thus recovered, against

3,694,470 long tons of washery recovered coal in 1909. In addition to the washery product there were 91,833 long tons in 1910 and 96,239 long tons in 1909 recovered from the bottom of Susquehanna River by means of dredges. The washery product of 1910 was smaller than in any year since 1906, the decrease in this item being probably due to the gradual disappearance of the culm banks.

A considerable quantity of bituminous coal is washed each year, most of this being the slack coal used in the manufacture of coke. In Illinois, however, the larger part of the coal washed is nut coal and is sold to the domestic trade. The total quantity of bituminous coal washed in 1910 was 18,395,382 short tons, an increase of about 1,853,500 short tons over 1909. The washing process yielded in 1910, 16,035,387 tons of cleaned coal and 2,359,995 short tons of refuse. A little over one third of the total quantity of coal washed was Alabama coal used for coke making. One fourth of the total was Pennsylvania coal, and most of this was also used in coke making. In Illinois the quantity of coal washed (principally for domestic use) was 2,453,208 tons.

Consumption.—Practically the entire output of both anthracite and bituminous coal in the United States is consumed within the country. The effort on the part of some of the operators in the Eastern States to build up an export trade has resulted in a considerable expansion of business along this line of some importance in itself but of comparative insignificance when considered with the total production. The total quantity of coal exported in 1910 was 15,462,570 short tons, or a little over 3 per cent. of the production. The consumption of coal of domestic production—that is, the total production less the quantity exported—of 1910 was 486,133,808 short tons. The imports amounted in 1910 to 1,686,612 short tons, which, added to the consumption of domestic coal, made the total consumption in that year 487,820,420 short tons, which is equivalent to 97.25 per cent. of the domestic production. In this statement no account is taken of the stock on hand at the beginning and the end of the year. The coal-mining industry is at best of a hand-to-mouth character, and stocks do not figure in the trade.

COAL PRODUCTION OF THE UNITED STATES IN 1910, BY STATES AND TERRITORIES IN SHORT TONS.

State or Territory.	Total quantity.	Total value.	Average price per ton.	Average number of days active.	Average number of employees.
Alabama	16,111,462	$20,236,853	$1.26	240	22,230
Arkansas	1,905,958	2,979,213	1.56	128	5,568
California and Alaska	12,164	33,336	2.74	189	19
Colorado	11,973,736	17,026,934	1.42	236	15,864
Georgia	177,245	259,122	1.46	265	386
Idaho	4,448	17,426	3.92	200	14
Illinois	45,900,246	52,405,897	1.14	160	72,645
Indiana	18,389,815	20,813,659	1.13	229	21,878
Iowa	7,928,120	13,903,913	1.75	218	16,666
Kansas	4,921,451	7,914,709	1.61	148	12,870
Kentucky	14,623,319	14,405,887	.99	221	20,316
Maryland	5,217,125	5,835,058	1.12	270	5,809
Michigan	1,534,967	2,930,771	1.91	211	3,575
Missouri	2,982,433	5,328,285	1.79	154	9,691
Montana	2,920,970	5,319,322	1.82	239	3,837
New Mexico	3,508,321	4,877,151	1.39	283	3,585
North Dakota	399,041	595,139	1.49	207	534
Ohio	34,209,668	35,932,288	1.05	203	46,641
Oklahoma	2,646,226	5,867,947	2.22	144	8,657
Oregon	67,533	235,229	3.48	257	153
Pennsylvania, bituminous	150,521,526	153,029,510	1.02	238	175,403
Tennessee	7,121,380	7,925,350	1.11	225	11,930
Texas	1,892,176	3,160,965	1.67	234	4,197
Utah	2,517,809	4,224,556	1.68	260	3,053
Virginia	6,507,997	5,877,486	.90	241	7,264
Washington	3,911,899	9,764,465	2.50	256	6,314
West Virginia	61,671,019	56,665,061	.92	228	68,663
Wyoming	7,533,088	11,706,187	1.55	248	7,771
Total bituminous	417,111,142	$469,281,719	$1.12	217	555,533
Pennsylvania, anthracite	84,485,236	160,275,302	1.90	229	169,497
Grand total	501,596,378	$629,557,021	$1.25	220	725,030

BITUMINOUS COAL MINED BY MACHINES IN THE UNITED STATES IN 1910, BY STATES AND TERRITORIES.

State or Territory.	Number of machines in use.	Number of tons mined by machines.
	1910	1910
Alabama	317	2,980,122
Arkansas	12	13,383
Colorado	256	1,905,781
Illinois	1,361	17,730,298
Indiana	645	8,986,495
Iowa	17	22,158
Kansas	13	34,240
Kentucky	899	9,362,851
Maryland	38	137,216
Michigan	100	698,191
Missouri	96	553,656
Montana	99	866,401
New Mexico	3	71,609
North Dakota	13	165,366
Ohio	1,452	28,887,241
Oklahoma (Indian Territory)	13	28,166
Pennsylvania	5,505	68,501,041
Tennessee	178	1,226,672
Texas	14	20,360
Utah	7	24,000
Virginia	142	2,290,435
Washington	10	56,000
West Virginia	1,966	27,981,617
Wyoming	98	1,468,994
Total	13,254	174,012,293

PRODUCTION OF COAL IN THE UNITED STATES FROM 1814 TO THE CLOSE OF 1910, IN SHORT TONS.

Year.	Pennsylvania anthracite.	Bituminous.	Total.	Year.	Pennsylvania anthracite.	Bituminous.	Total.
1814..	22	.....	22	1863..	11,785,320	9,533,742	21,319,062
1815..	50	.....	50	1864..	12,538,649	11,066,474	21,319,062
				1865..	11,891,746	11,900,427	23,792,173
1816..	75	.....	75				
1817..	100	.....	100	1866..	15,651,183	13,352,400	29,003,583
1818..	200	.....	200	1867..	16,002,109	14,722,313	30,724,422
1819..	350	.....	350	1868..	17,003,405	15,858,555	32,861,960
1820..	450	3,000	3,450	1869..	17,083,134	15,821,226	32,904,360
				1870..	15,664,275	17,371,305	33,035,580
1821..	1,322	.....	1,322				
1822..	4,583	54,000	58,583	1871..	19,342,057	27,543,023	46,885,080
1823..	8,563	60,000	68,563	1872..	24,233,166	27,220,233	51,453,399
1824..	13,685	67,040	80,725	1873..	26,152,837	31,449,643	57,602,480
1825..	42,988	75,000	117,988	1874..	24,818,790	27,787,130	52,605,920
				1875..	22,485,766	29,862,554	52,348,320
1826..	59,194	88,720	147,914				
1827..	78,151	94,000	172,151	1876..	22,793,245	30.486,755	53,280,000
1828..	95,500	100,408	195,908	1877..	25,660,316	34,841,444	60,501,760
1829..	138,086	102,000	240,086	1878..	21,689,682	36,245,918	57,935,600
1830..	215,272	104,800	320,072	1879..	30,207,793	37,898,006	68,105,799
				1880..	28,649,812	42,831,758	71,481,570
1831..	217,842	120,100	337,942				
1832..	447,550	146,500	594,050	1881..	31,920,018	53,961,012	85,881,030
1833..	600,907	133,750	734,657	1882..	35,121,256	68,429,933	103,551,189
1834..	464,015	136,500	600,515	1883..	38,456,845	77,250,680	115,707,525
1835..	690,854	134,000	824,854	1884..	37,156,847	82,998,704	120,155,551
				1885..	38,335,974	72,824,321	111,160,295
1836..	842,832	142,000	984,832				
1837..	1,071,151	182,500	1,253,651	1886..	39,035,446	74,644,981	113,680,427
1838..	910,075	445,452	1,355,527	1887..	42,088,197	88,562,314	130,650,511
1839..	1,008,322	552,038	1,560,360	1888..	46,619,564	102,040,093	148,659,657
1840..	967,108	1,102,931	2,070,039	1889..	45,546,970	95,682,543	141,229,513
				1890..	46,468,641	111,302,322	157,770,963
1841..	1,182,441	1,108,700	2,291,141				
1842..	1,365,563	1,244,494	2,610,057	1891..	50,665,431	117,901,238	168,566,669
1843..	1,556,753	1,504,121	3,060,874	1892..	52,472,504	126,856,567	179,329,071
1844..	2,009,207	1,672,045	3,681,252	1893..	53,967,543	128,385,231	182,352,774
1845..	2,480,032	1,829,872	4,309,904	1894..	51,921,121	118,820,405	170,741,526
				1895..	57,999,337	135,118,193	193,117,530
1846..	2,887,815	1,977,707	4,865,522				
1847..	3,551,005	1,735,062	5,286,067	1896..	54,346,081	137,640,276	191,986,357
1848..	3,805,942	1,968,032	5,773,974	1897..	52,611,680	147,617,519	200,229,199
1849..	3,995,334	2,453,497	6,448,831	1898..	53,382,644	166,593,623	219,976,267
1850..	4,138,164	2,880,017	7,018,181	1899..	60,418,005	193,323,187	253,741,192
				1900..	57,367,915	212,316,112	269,684,027
1851..	5,481,065	3,253,460	8,734,525				
1852..	6,151,957	3,664,707	9,816,664	1901..	67,471,667	225,828,149	293,299,816
1853..	6,400,426	4,169,862	10,570,288	1902..	41,373,595	260,216,844	301,590,439
1854..	7,394,875	4,582,227	11,977,102	1903..	74,607,068	282,749,348	357,356,416
1855..	8,141,754	4,784,919	12,926,673	1904..	73,156,709	278,659,689	351,816,398
				1905..	77,659,850	315,062,785	392,722,635
1856..	8,534,779	5,012,146	13,546,925				
1857..	8,186,567	5,153,622	13 340,189	1906..	71,282,411	342,874,867	414,157,278
1858..	8,426,102	5,548,376	13,974,478	1907..	85,604,312	394,759,112	480,363,424
1859..	9,619,771	6,013,404	15,633,175	1908..	83,268,754	332,573,944	415,842,698
1860..	8,115,842	6,494,200	14,610,042	1909..	81,070,359	379,744,257	460,814,616
				1910..	84,485,236	417,111,142	501,596,378
1861..	9,799,654	6,688,358	16,488,012				
1862..	9,695,110	7,790,725	17,485,835		2,180,334,670	6,063,016,589	8,243,351,259

The foregoing table shows the total production of anthracite in Pennsylvania since 1814, the total production of bituminous coal since 1820, and the total annual production to the close of 1910. During the period covered by this table the total production of anthracite in Pennsylvania has amounted to 2,180,334,670 short tons, that of bituminous coal to 6,063,016,589 short tons, and that of the whole country to 8,243,351,259 short tons. Of the grand total the anthracite mines of Pennsylvania have contributed a little more than 25 per cent., and a little less than 75 per cent. is represented by the production of bituminous coal.

The annual production of each State, from the time of earliest record to the close of 1910, is given in connection with the discussion of the production in the several States.

Production by Classes of Mines.

In the following tables the production of coal in the United States in 1910 has been distributed according to the importance of the producing mines. The mines have been divided into five classes: First, mines producing 200,000 short tons or more during the year; second, mines producing from 100,000 to 200,000 short tons; third, mines producing between 50,000 and 100,000 short tons; fourth, mines producing between 10,000 and 50,000 tons; and fifth, mines producing less than 10,000 tons. In this compilation no account is taken of the small mines operated for purely local trade, nor of the anthracite recovered from old culm banks or river beds. Some producers in making their reports to the Survey combine the production of two or more mines on one schedule; in such cases the production of each mine has been assumed to be the average of all of the mines covered by the schedule.

The table shows that the production in the anthracite region of Pennsylvania is conducted in much greater proportion by large units than is done in the bituminous fields. There were 157 first-class mines in the anthracite region in 1910; they constituted 51 per cent. of the total number and yielded 82.5 per cent. of the total output. The bituminous mines of the first class made 10.6 per cent. of the total number

and they produced 46 per cent. of the total output. Eighty per cent. of the anthracite mines in both 1909 and 1910 were included among the first three classes; that is, mines producing more than 50,000 tons each, and this 80 per cent. of mines contributed 99 per cent. of the total production. In the bituminous mines there were 37.8 per cent. of the total number in 1909 and 40.2 per cent. in 1910 that produced over 50,000 tons, and these produced 87.4 per cent. of the total output in 1909 and 88.2 per cent. of the total in 1910.

Among the bituminous-producing States and Territories New Mexico leads in the proportion of tonnage by the larger units. Eighty-eight per cent. of New Mexico's total production in 1910 were from mines of the first class. Nine mines out of 31 in 1910 produced over 200,000 tons. Utah ranks second in the proportion of production by large units. Maryland was credited with the largest average output from mines of the first class, with 583,044 tons as the average for 4 such mines, while the production from 4 first-class mines in Montana averaged 476,812 tons each, and the average output from the 5 first-class mines in Utah was 403,876 tons. In 1910, 77 per cent. of Utah's production was from first-class mines and the average production was 387,350 short tons; 65.4 per cent. of Montana's production, 59.7 per cent. of Washington's, and 60.4 per cent. of Wyoming's were from mines of the first class.

Pennsylvania was the only State east of the Mississippi in which more than half of the production was from mines of the first class. West Virginia, the second State in coal-producing importance, presents a peculiar case in that only 23.5 per cent. of its total production in 1909 and 35.4 per cent. in 1910 was from mines of the first class, but 37 per cent. of its total production in 1909 and 30.6 per cent. in 1910 was from mines of the second class. The fourth and fifth class mines in 1910 represented 60 per cent. of the total number of mines and contributed a little over 10 per cent. of the total production.

PRODUCTION OF COAL IN THE UNITED STATES IN 1910 ACCORDING TO CLASSES OF MINES, IN SHORT TONS.

1910.

State.	Mines producing 200,000 tons and over.					Mines Producing from 100,000 to 200,000 tons.					Mines producing from 50,000 to 100,000 tons.				
	Mines.		Production.			Mines.		Production.			Mines.		Production.		
	Number.	Percentage.	Total.	Average per mine.	Percentage.	Number.	Percentage.	Total.	Average per mine.	Percentage.	Number.	Percentage.	Total.	Average per mine.	Percentage.
Alabama	18	8.1	4,182,595	232,366	26.0	50	22.6	6,932,110	138,642	43.0	37	16.8	2,732,495	73,851	16.9
Arkansas	...	....	.....	.....	....	5	7.9	627,493	125,499	32.9	9	14.3	612,998	68,111	32.2
California	...	....	.....	.....	....	...	....	.....	.....	....	...	....	.....	.....	....
Colorado	18	9.4	5,425,791	301,433	45.3	20	10.5	2,508,167	125,408	20.9	31	16.2	2,425,513	78,242	20.3
Georgia	...	....	.....	.....	....	1	33.3	151,073	151,073	85.2	...	....	.....	.....	....
Idaho	...	....	.....	.....	....	...	....	.....	.....	....	...	....	.....	.....	....
Illinois	58	10.3	20,151,755	347,444	44.0	102	18.1	14,408,916	141,264	31.4	96	17.1	7,183,676	74,830	15.7
Indiana	29	11.6	7,576,184	261,248	41.2	46	18.3	6,858,477	149,097	37.4	34	13.6	2,539,523	74,398	13.8
Iowa	2	.7	467,959	233,980	5.9	25	9.3	3,265,393	130,616	41.4	27	10.1	1,976,610	73,208	25.0
Kansas	...	....	.....	.....	....	2	1.3	290,449	145,225	5.9	40	25.8	2,796,638	69,919	57.4
Kentucky	9	3.1	2,327,162	258,753	16.0	42	14.5	5,739,041	136,644	39.5	52	17.9	3,514,406	67,585	24.2
Maryland	4	5.5	2,332,174	583,044	44.8	6	8.2	926,818	154,470	17.8	12	16.4	961,393	80,116	18.5
Michigan	...	....	.....	.....	....	6	18.8	667,677	111,280	43.5	9	28.1	645,336	71,704	42.1
Missouri	...	....	.....	.....	....	3	1.4	363,438	121,146	12.7	15	7.2	1,099,818	73,321	38.3
Montana	4	7.0	1,907,248	476,812	65.4	3	5.3	444,449	148,150	15.2	1	1.8	61,352	61,352	2.1
New Mexico	9	29.1	3,087,521	343,058	88.2	1	3.2	144,344	144,344	4.1	1	3.2	73,106	73,106	2.1
North Dakota	...	....	.....	.....	....	1	2.3	136,197	136,197	36.7	...	....	.....	.....	....
Ohio	50	7.2	14,962,570	299,251	44.0	68	9.9	10,148,608	149,244	29.8	57	8.3	3,882,830	68,120	11.4
Oklahoma	...	....	.....	.....	....	2	2.0	200,966	100,483	7.6	17	17.4	1,136,433	66,849	43.1
Oregon	...	....	.....	.....	....	...	....	.....	.....	....	...	....	.....	.....	....
Pennsylvania bituminous	280	19.6	93,458,444	323,386	62.1	190	12.9	27,085,391	142,556	18.04	254	17.2	18,405,748	72,464	12.2
Tennessee	7	5.4	1,967,408	281,058	27.6	12	9.3	1,662,322	138,527	23.4	27	20.9	1,832,580	67,873	25.7
Texas	1	2.3	223,481	223,481	11.8	2	4.6	253,628	126,814	13.4	10	23.3	731,170	73,170	38.7
Utah	5	22.7	1,936,750	387,350	77.0	3	13.6	365,881	121,960	14.5	2	9.1	121,204	60,602	4.8
Virginia	7	11.1	2,827,133	403,876	43.4	13	20.6	2,140,050	164,619	32.9	14	22.2	916,560	65,469	14.1
Washington	9	18.8	2,333,342	259,260	59.7	5	10.4	527,262	105,452	13.5	11	22.9	720,552	65,505	18.4
West Virginia	83	11.6	21,806,147	262,725	35.4	139	19.4	18,866,228	135,728	30.6	197	27.5	14,094,862	71,548	22.9
Wyoming	16	24.2	4,545,011	284,063	60.4	16	24.2	2,337,675	146,106	31.0	7	10.6	402,942	57,563	5.4
Total bituminous	618	10.6	191,518,675	309,901	46.0	763	13.1	107,052,053	140,304	25.7	960	16.5	68,858,273	71,727	16.5
Pennsylvania anthracite	157	51.0	65,788,484	419,035	82.5	64	20.8	10,664,819	166,638	13.4	26	8.4	2,281,971	87,768	2.9
Grand total	775	12.7	257,307,159	332,009	51.9	827	13.5	117,716,872	142,342	23.7	986	16.1	71,140,244	72,150	14.3

PRODUCTION OF COAL IN THE UNITED STATES IN 1910 ACCORDING TO CLASSES OF MINES IN SHORT TONS—*Continued.*

State	Mines producing from 10,000 to 50,000 tons.					Mines producing less than 10,000 tons.					Total.		
	Mines.		Production.			Mines.		Production.			Mines.	Quantity.	Average per mine.
	Number.	Percentage.	Total.	Average per mine.	Percentage.	Number.	Percentage.	Total.	Average per mine.	Percentage.			
Alabama	77	34.8	2,089,845	27,141	13.0	39	17.7	174,107	4,464	1.1	221	16,111,152	72,901
Arkansas	21	33.3	545,989	25,999	28.7	28	44.5	119,058	4,252	6.2	63	1,905,538	30,247
California	....	....	....	....	....	4	100.0	11,164	2,791	100.0	4	11,164	2,791
Colorado	54	28.3	1,468,896	27,202	12.3	68	35.6	140,671	2,069	1.2	191	11,969,038	62,665
Georgia	1	33.3	25,000	25,000	14.1	1	33.3	1,172	1,172	.7	3	177,245	59,082
Idaho	....	....	....	....	....	3	100.0	4,448	1,483	100.0	3	4,448	1,483
Illinois	129	23.0	3,378,019	26,186	7.4	177	31.5	696,311	3,934	1.5	562	45,818,677	81,528
Indiana	38	15.1	1,063,026	27,974	5.8	104	41.4	324,514	3,120	1.8	251	18,351,724	73,114
Iowa	76	28.4	1,847,480	24,309	23.4	138	51.5	336,268	2,437	4.3	268	7,893,710	29,454
Kansas	54	34.8	1,523,246	28,208	31.2	59	38.1	272,847	4,625	5.6	155	4,883,180	31,504
Kentucky	91	31.4	2,580,920	28,362	17.7	96	33.1	373,681	3,893	2.6	290	14,535,210	50,121
Maryland	27	37.0	907,999	33,630	17.5	24	32.9	74,768	3,115	1.4	73	5,203,152	71,276
Michigan	12	37.5	213,600	17,800	13.9	5	15.6	7,168	1,434	.5	32	1,533,781	47,931
Missouri	38	18.3	810,253	21,322	28.2	152	73.1	595,418	3,917	20.8	208	2,868,927	13,793
Montana	17	29.8	410,288	24,135	14.1	32	56.1	94,136	2,942	3.2	57	2,917,473	51,184
New Mexico	8	25.8	162,029	20,254	4.6	12	38.7	33,335	2,778	1.0	31	3,500,335	112,914
North Dakota	7	15.9	158,895	22,699	42.8	36	81.8	76,361	2,121	20.5	44	371,453	8,442
Ohio	167	24.2	3,984,206	23,858	11.7	348	50.4	1,039,496	2,987	3.1	690	34,017,716	49,301
Oklahoma	46	46.9	1,153,991	25,087	43.7	35	33.7	148,824	4,510	5.6	98	2,640,214	26,941
Oregon	2	18.2	51,119	25,560	76.3	9	81.8	15,880	1,764	23.7	11	66,999	6,091
Pennsylvania bituminous	367	24.8	9,990,563	27,222	6.7	376	25.5	1,469,688	3,909	1.0	1,476	150,409,834	101,904
Tennessee	53	41.1	1,552,378	29,290	21.8	30	23.3	105,154	3,505	1.5	129	7,119,842	55,193
Texas	26	60.5	675,620	25,985	35.7	4	9.3	7,749	1,937	.4	43	1,892,176	44,004
Utah	2	9.1	64,530	32,265	2.6	10	45.5	27,234	2,723	1.1	22	2,515,599	114,345
Virginia	20	31.8	583,268	29,163	9.0	9	14.3	38,289	4,254	.6	63	6,505,300	103,259
Washington	11	22.9	291,184	26,471	7.4	12	25.0	39,559	3,297	1.0	48	3,911,899	81,498
West Virginia	218	30.5	6,551,193	30,051	10.6	79	11.0	287,188	3,635	.5	716	61,605,618	86,041
Wyoming	6	9.1	198,484	33,081	2.6	21	31.9	46,747	2,226	.6	66	7,530,859	114,104
Total bituminous	1,568	27.0	42,282,021	29,966	10.2	1,909	32.8	6,561,235	3,437	1.6	5,818	416,272,257	71,549
Pennsylvania anthracite	28	9.1	812,517	29,018	1.0	33	10.7	147,808	4,479	.2	308	79,695,599	258,752
Grand total	1,596	26.0	43,094,538	27,002	8.7	1,942	21.7	6,709,043	3,458	1.4	6,126	495,967,856	80,961

The influence of the strike in Illinois in 1910 was shown by a decrease from 97 to 58 in the number of mines producing over 200,000 tons, and the percentage of the total output from these mines decreased from 60 per cent. to 44 per cent. The second-class mines in Illinois increased from 80 in 1909 to 102 in 1910, and the percentage of the total production from this class increased from 22.1 to 31.4 per cent. Kansas and Arkansas each had 3 first-class mines in 1909 and none in 1910; Missouri had 2 in 1909 and none in 1910; whereas Kentucky, which benefitted from the strike in the other states, showed an increase from 3 to 9 in the number of first-class mines and from 7 to 16 in the percentage of the product from such mines.

Mining is one of the two great basic industries, the other being agriculture. Coal is the principal mineral product and it is the product on which practically all lines of transportation and manufacture depend for existence. The value of the coal production, compared with that of any of the principal agricultural products, or with the total value of the products of agriculture, puts mining apparently in a bad second place. The value of the agricultural products in 1910 was more than four times the total value of the mineral output. The corn crop during the last three years has averaged in value over $1,600,000,000, two and a half times the value of the coal output in 1910. The products of the barnyard, exclusive of the dairy products, exceed the combined value of all the metals, including gold, silver, iron, copper, lead, zinc, aluminum, quicksilver, etc. But it must be remembered that in the utilization of the products of agriculture and mining there are two essential differences—(1) that with the exception of a portion of the products of the forest used in building and in the industrial arts, all of the products of the farm, the garden, and the ranch are consumed in their utilization for the needs of man. The products of the mines and the quarries, on the other hand, with the exception of the fuels and some of the chemical products, such as salt, sulphur and phosphate rock, are not consumed in being applied to man's use, but become a part of the permanent wealth of communities. (2) The products of the soil are perennial, one

growth and harvest being succeeded by another, which will continue as long as the world and time last, but the contents of the mines are stored products, and once exhausted are never replenished.

According to the report of the Interstate Commerce Commission for the year ended June 30, 1910, the coal production of the United States furnishes the transportation companies one third of their total tonnage. The total originated tonnage of the freight traffic for the year mentioned was 968,464,000 tons, of which the coal mines contributed 324,335,000 tons.

The agricultural products furnish about 8 per cent. of the railroad tonnage.

I have shown that our stores of coal are vast, but they are by no means limitless. Many generations will come and go before our storehouses are exhausted, but we are drawing upon them at an enormous and constantly increasing rate, and they should receive the consideration of every one who is interested in the conservation of our mineral resources. Conservation should, however, be tempered by reason, and should not operate to the hoarding and non-use of our resources, but to their exploitation, development, and utilization with the greatest efficiency for our present needs and with the elimination of every unnecessary waste.

WAGES IN MASSACHUSETTS AND NEW JERSEY.*

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Students of Economic Standards, the Cost of Living, and Wage Theories have for a long time been hampered in their investigations by a lack of reliable wage statistics. The need of such statistics is apparent. Any one who has worked in a field which depends immediately or remotely upon the problem of income is aware of the intimate connection between reliable wage data and many fundamental social problems.

Most of the states and, in many instances, the federal government publish wage statistics which are neither reliable nor conclusive because of the unscientific methods of investigation and compilation. Thus much of the wage data published by the various state and federal authorities is most unsatisfactory. During recent years, however, a decided change has been made by many of the officials and real efforts have been put forth to secure reliable wage data. Among the states which have succeeded best in this endeavor there are two, Massachusetts and New Jersey, which stand out pre-eminently for the method of securing their wage statistics as well as for the method of publishing them; in fact, the wage figures presented in the reports of these two states are so generally superior as to make all other state statistics appear inadequate. Hence the following study is presented dealing with the statistics of Massachusetts and New Jersey.

I. Average Versus Classified Wages.

An average wage is obtained by taking the various wages under consideration, adding them together, and dividing by the number of wage groups.

The average is an abstract concept, which, though math-

* All of the figures in the present study are taken from the reports of the Massachusetts Bureau of Statistics and the Bureau of Statistics of New Jersey. The figures in Chapter IV relate to the whole series of reports issued by these two bureaus. With this one exception, all of the wage statistics are from the Massachusetts Annual Report on the Statistics of Manufactures for the year 1908, and from the Annual Report of the Bureau of Statistics for the State of New Jersey, 1909.

matically correct, is socially misleading. The statement that the average wage in the building trades is $3 a day leads at once to the conclusion that building-trade employees can provide for themselves a certain quantity of coal, potatoes, woolen clothing, and the other necessaries of life. In other words, men think of wages in terms of purchasing power, yet this $3 wage does not represent the purchasing power of any one individual, hence is misleading if stated without reservations.

The weighted average by giving to each wage an importance proportionate to the numbers of men employed at that wage, gives a more accurate idea of the wage in the industry. But the same objection may be urged against the weighted average that was urged against the mathematical average. There is no one group of workers who receive even a weighted average wage. The average is still an abstraction, for the five dollar bricklayer never pays the butcher's bill for the two dollar hod carrier. Each man lives on his own wages. An average merely de-humanizes wage statistics.

Since, this is unquestionably a fact, it is most unfortunate that a majority of the available wage statistics are "average." However, a few of the state reports and the special wage reports recently published by the Federal government present absolute wages. By grouping wages according to earnings, a very accurate idea of the wages in any particular trade may be secured. An excellent illustration of this method is furnished in the Report of the Bureau of Statistics of New Jersey for 1909 (page 85).

NUMBER OF PERSONS RECEIVING SPECIFIED AMOUNTS.

Classified Weekly Earnings.	Men 16 Years and Over.	Women 16 Years and Over.	Children Under 16.	Total Number Receiving Specified Amounts.
Under $5	77	1,610	321	2,008
$5- 6	74	967	15	1,056
6- 7	170	897	3	1,070
7- 8	173	601	..	774
8- 9	165	224	..	384
9-10	195	149	..	344
10-12	227	126	..	353
12-15	221	38	..	259
15-20	155	9	..	164
20 and over	95	1	..	96
Total	1,552	4,622	339	6,513

This method does not of course give the earnings in individual occupations within the industry, though that may be succeessfully done by an elaboration of this method.*

For most industries the New Jersey method remains an effective one. It shows clearly, by age, sex, and industry, exactly what wages are being paid and in what proportion. In the cotton goods industry, for example, some employees receive over $25 per week, 49 men in all. The number who receive $6 to $7 per week (1070) is twenty times as great. The table thus furnishes a definite idea of the distribution of wage earners over the various wage groups. It is, moreover, susceptible of computation for the state at large.

II. The Massachusetts Method.

The Massachusetts Bureau of Statistics has adopted a schedule similar in most particulars to that employed in New Jersey. The statistical year, for the purposes of this schedule, ends December 31st. On the blanks which are mailed annually to manufacturers throughout the state, there appears a notice to the effect that twenty days from January 1st of the stated year are allowed by law in which the schedule may be filled out and returned. The Bureau of Statistics further assures the manufacturer that the names of persons will in no case be printed and the business of manufacturers individually will not be divulged. Penalties are provided for the punishment, first, of any state employee who may make public answers given in the schedules, and, second, for the manufacturer who fails to make his returns within a specified time. The firm or individual filling in the schedule is compelled to certify as to the correctness of the statements made.

There are ten questions in all which relate to:

(1) and (2) Name and character of firm, (3) Capital invested, (4) Materials used, (5) Goods made, (6) Total wages, (7) Persons employed, (8) Wage earners employed December 17th, (9) Classified weekly wages, and (10) Days in operation. The first five questions do not directly affect the problem of wages. On the remaining questions, some emphasis will be laid.

* Report on Strike at South Bethlehem, Charles P. Neill, Senate Document 521, 61st Congress, 2nd Session, 58–59, 1910, pp. 61–108.

Total wages are stated in reply to Question 6. "The object of this inquiry is to ascertain the amount of wages paid during the year to all those who work by the six-day week, etc., whose labor directly produced or added to the value of the articles made. The salaries of agents, manufacturers, bookkeepers, clerks, and others of this class should be omitted." By these provisions the Bureau of Statistics aims to secure returns for wage earners alone.

Question 7 relates to persons employed, during each month of the year,—the persons being divided into males, females, and totals for both. Where the number of persons varies during any month, the average is to be obtained thus. "Take from your pay roll for each week all wage earners, classified as to sex, and add the numbers together, dividing the total thus obtained by the number of weeks. For shut downs and stoppages for repairs the average for the month should be proportionately reduced." All persons who receive a yearly salary, such as agents, manufacturers, clerks, bookkeepers, and the like, are omitted from this answer. The answers to Questions 6 and 7 taken together should give a basis for the computation of average wages as well as for a statement of total wages paid and total wage earners employed throughout the year.

In order to ascertain the condition of employment on a given date, (in 1910, on December 17th) Question 8 asks for the wage earners employed on that day. The most important statistics collected on the schedule are secured in response to Question 9, which refers to classified weekly wages. Question 9 in full is as follows:

QUESTION 9. CLASSIFIED WEEKLY WAGES (WAGE EARNERS ONLY).

Specified Wages (Rates) Paid for the Week during which the Largest Number of Persons was Employed.	Adults 18 Years of Age and Over.		Young Persons (under 18 years of Age).	Totals.
1	Males.	Females.		
Under $3				
$3 but under $5				
$5 but under $6				
$6 but under $7				
(and Continuing to "$25 and over")				

The object of question 9 is "to ascertain the *rates* of wages whether paid by day, week, or month." These figures are given "for the week during which the largest number of persons was employed." In estimating for piece work, a normal day only is considered, no allowance being made for over time. If the firm reporting prefers, it is permitted to send a transcript of its payroll instead of a compiled answer to this questtion. The number of days in operation, which is secured in answer to question 10, provides the only statistics from which the amount of unemployment can be deduced. In answering this question, the number of days the plant was in operation on full time should be given separately from the number of days run on three quarters time, on one half time, on less than one half time, and the number of days idle.

The answers to these ten questions which constitute the available material on wages in Massachusetts are compiled and published by the Bureau of Statistics under the heading, "Statistics of Manufactures." After discussing the number of establishments making returns during the various years, the report, under six tables, compiles all the answers received to the schedules. Table 1, including a compilation of answers received on Questions 1 to 6, gives in detail: (1) Number of establishments, (2) Capital devoted to Production, (3) Value of Stock and Materials used, (4) Amount of Wages paid during the year, (5) Average yearly earnings, (6) Wage earners employed, (a) Average number of: *a* Males, *b* Females, *c* Both sexes, (b) Smallest number, (c) Largest number, and (7) Value of product.

These statistics are compiled: (a) For the entire state by industries, (b) for the thirty-three cities by industries, and (c) for one hundred and eight towns by industries.

Table 2 in a report for 1908 covers in detail the boot and shoe industry. In table 4 appears a tabulation by industries of the answers made to Question 7 as to the number of persons employed during each month. Table 5 includes, by industries, the classified weekly wages as stated in the answers to Question 9. These wages are classified in considerable detail, referring to industries and their subdivisions. There are three parts

to table 6, which furnishes the statistics of time worked by cities and towns, by industries and by counties.

All of this tabulated material appears in one hundred and twenty-six pages, well tabulated, compiled apparently with great care and in a form readily available for statistical study. It permits of accurate analysis of average and classified wages in Massachusetts and of the extent of unemployment upon which so much depends in discussing the wages in a given area.

Another group of statistics regarding the changes in the rate of wages during the current year is secured on the schedules furnished to trade unions as well as to manufacturers. Were it possible to secure from trade union sources accurate statements regarding the amount of wages as well as the changes in wages, wage data of incalculable value could be compiled. Unfortunately, under present conditions, such a possibility seems fairly remote.

III. The New Jersey Method.

In view of the similarity already noted between the wage statistics in New Jersey and Massachusetts, no extended comment will be made on the New Jersey schedule. As in Massachusetts, the data furnished by the manufacturer is held absolutely confidential. The penalty for failure to provide the information requested is a fine of fifty dollars for each offense.

On the New Jersey schedule, Questions 1 to 4 are similar to that of Massachusetts. Question 5, differing slightly from the Massachusetts question, requires that "one or two of the principal articles of material used in manufacture" be entered on the schedule. The principal articles or goods made, and the total value of all products is given in answer to Question 6, while the answer to Question 7, stated exactly the same as the Massachusetts question, relates to the total amount of wages paid during the year.

The purpose of Question 8 is the same in both states, but the New Jersey Schedule is distinctly superior to the Massachusetts schedule in one respect. The Massachusetts question relating to the number of persons employed requires a statement of their number by months for "males," "females,"

and "totals." The New Nersey question requires the same information for "males sixteen years and over," "females, sixteen years and over," and "children under sixteen years."

The classified wage statistics in Massachusetts were up to 1908 given for "males twenty-one years and over," "females twenty-one years and over," and "young persons under twenty-one years of age." In 1909, however, the age was changed to eighteen. The reason for this age is not clear because most of the legislation upon the subject of child work relates to sixteen amd most of the wage schedules of the country publish wages above and below sixteen years of age. Therefore, for the purposes of comparison with the census, with factory reports, or with other states, sixteen, the age adopted by New Jersey, is preferable. Question 10 relates to unemployment, stated in terms of percentage, which the amount of business done during the year under discussion bore to the full capacity of the plant. The time during which the factory was in operation was stated in number of days per year, number of hours per day, number of hours per week, and total extra time during the year. This information is called for by Question 11. The substance of both of these questions was secured in Massachusetts by Question 10 regarding the number of days in operation.

A considerable difference appears, however, in the method of presentation adopted in the two states. The material derived from the New Jersey schedule is published in twelve tables. Tables 1 to 3 are irrelevant to this study. The average number of persons employed together with the greatest and least number classified by industries appears in Table 4, and Table 5 includes a statement of the average number of wage earners employed by industries. In Table 6 there is a statement of the aggregate amounts paid in wages, together with the yearly earnings per employee classified by industries. In this classification the New Jersey statistics are markedly inferior to those in Massachusetts. The Massachusetts statistics are compiled by industries and very accurately classified and minutely subdivided.

All of the industries of New Jersey are published under eighty-nine headings, the last one, including miscellaneous,

without any apparent effort at thorough analysis and accurate description. For example, the following list of headings refers to textiles, "20 cotton goods," "21 cotton goods (finishing and dyeing)", "68 silk (broad and ribbon)," "69 silk (dyeing)," "70 silk (throwing)", "78 textile products," "88 woolen and worsted goods." It is manifestly impossible to determine from these descriptions exactly what industries are included. In sharp contrast with this desultory classification appears the accurate, clear-cut classification adopted by the Massachusetts bureau.

Table 8 of the New Jersey report contains a statement of the number of days in operation, the number of hours worked per day, the number of hours per week, and over time, with wages classified by industries. The material is, if anything, slightly more complete than that furnished by the Massachusetts bureau in the same connection, although in Massachusetts the classification is more complete by industries and localities. In Table 9 appears a statement of the proportion of business done, classified by industries, while table 10 details the power used, classified by kind of power and industry.

IV. Average Wages in Massachusetts and New Jersey, 1908–09.

Average wage statistics, while not nearly so valuable as the statistics of classified wages, nevertheless prove valuable in comparisons and lend themselves, within certain restricted bounds, to general deductions. For example, they permit of comparisons between industries and, to a limited extent, between the states publishing them. In Massachusetts there were, according to the 1908 figures, 480,134 wage earners of whom 323,308 were males and 156,826 females, employed in 6,044 establishments and receiving average yearly wages of $510.71.* Since no separate figures appear in this table for males, females, and young persons, the total average annual earnings alone are presented. Twenty-six Massachusetts industries during the year under consideration reported the employment of more than three thousand wage earners.

A study of this table shows that fourteen of the twenty-six

* Statistics of Manufactures for 1908, Public Document No. 36, Boston, 1909, p. 2.

industries report average annual earnings of less than $500, while twenty-two report average annual earnings under $600. The leading industries of Massachusetts,—the manufacture of cotton goods, of worsted goods, of paper and wood pulp, of woolen goods, of boots and shoes, of electric machinery,—pay annual wages of less than $600. On the other hand, a few industries, such as the manufacture of malt liquors, automobiles, tobacco, stoves, monuments and tomb stones, carriages and wagons, fire arms, foundry and machine shop products, and musical instruments, report average yearly earnings of more than $600. With the one exception of foundry and machine shop, employing 31,112 men, the large industries pay comparatively low average yearly wages.

The average earnings in New Jersey differ only slightly from those in Massachusetts. The method of computation is very similar and the number of New Jersey industries (25 in all), employing more than 3,000 persons, is almost the same as the number of such industries in Massachusetts (26). The industries of New Jersey differ from those of Massachusetts in one respect; they vary less in the number of persons employed. In Massachusetts there are four industries, cotton goods, worsted goods, boots and shoes, and foundry and machine shop products, each employing more than 25,000 persons. With these exceptions, most of the Massachusetts industries employed comparatively small numbers. In New Jersey employment is more evenly distributed.

In 2,127 establishments, reporting in 1908, there were employed 278,964 persons, who received an average annual wage of $500.14.* There is thus a difference of only ten dollars between the average annual earnings of all employees in Massachusetts and in New Jersey.

Here the Massachusetts industries show slightly higher than those of New Jersey though the difference is not material. In so far as these average wage statistics permit of conclusions, they show that, in the first place, the average earnings of all employees in two of the leading industrial states are about $500; that this amount is apparently increased in those industries which are dominated by men, and decreased in those

* Bureau of Statistics of New Jersey, 1909, Camden, 1910, pp. 74, 75.

industries which are dominated by women; and that the typical industries of the state,—those employing the largest number of persons,—in most cases pay less than $600, the higher annual earnings being paid in the comparatively small industries.

The material thus far presented has dealt only with the current year. There is, however, another very distinct problem. "What is happening to wages?" In Massachusetts, the available material goes back only to 1903, while in New Jersey it extends back to 1897. In neither case do the wage statistics cover a representative period of depression and prosperity. Yet the period covered is sufficiently extended to be worthy of some comment.

Both states publish average wages. A glance at the table for Massachusetts shows a steadily rising wage not only in the industries of the state, but in the six most representative industries as well. In the state at large, average yearly earnings have increased slightly less than 10 per cent., a figure which holds with marked similarity throughout all of the separate industries included in the table. Apparently so far as average wages are concerned, according to the index of conditions, there was a constant rise between 1903 and 1907 in the averages wages among all groups of workers in Massachusetts.

The average wages in New Jersey are available over a much longer period, yet the results differ very little from those in Massachusetts, save that the increase in average wage has been considerably greater in New Jersey than in the latter state. In all of the New Jersey industries, the increase in average wages has been about 25 per cent. In the manufacture of machinery, of oils, and of chemical supplies, the rate of increase was about the same, while it was somewhat greater in the woolen and worsted industry (35 per cent.) and considerably less in the silk industry (50 per cent.). Nevertheless, with the exception of the silk industry, all of the New Jersey industries show a very marked increase in average wages between 1897 and 1908. A study of the wage table shows that one half of the adult male and nine tenths of the adult female wage earners in Massachusetts were receiving less than $12 per week while less than 2 per cent. of the young

persons under twenty-one years of age received more than $12 per week. Furthermore of those employed, 114 of the males received over $15 per week,—a wage secured by only one fiftieth of the adult females.

In New Jersey classified weekly earnings for all industries range much the same as those in Massachusetts. Adult males and females are sixteen years and over instead of twenty-one years and over as in Massachusetts. Hence the difference in the wages of young persons in the two states might be expected. Making allowances for the slight influence which such a difference must exercise over the wages of adult males and females, classified earnings in the two states are remarkably similar. One fourth of the men over sixteen and four fifths of the women over sixteen receive less than $9.00 a week, while one half of the men and nineteen twentieths of the women are paid less than $12.00.

The classified wage statistics, the most accurate procurable, are remarkably similar in both Massachusetts and New Jersey. In both states about 10 per cent. of the adult males and somewhat less than 1 per cent. of the adult females earn more than $20 per week. In both states, one quarter of all of the adult males and three fifths of all of the adult females earn less than $9 per week.

Turning now to the Statistics of Classified Wages for a series of years, we find that all Massachusetts industries, between 1903 and 1908, with the exception of 1907, for which year the figures were omitted, show a slight decrease in the percentages of persons receiving less than $9 a week, a practical uniformity in the percentage of persons receiving from $9 to $15 a week, and a considerable increase in the percentage of persons receiving over $15 a week. These figures, therefore, bear out in every particular the average figures which showed a constant rise in the average wages for all Massachusetts wage earners. The statistics of classified wages for females lead to exactly the same conclusions. Among this group of workers as well as among the males, there is a slight decrease in the percentages receiving lower rates of wages, and a slight increase in the percentages of those receiving higher rates of wages, although the increase among the higher group is less for

females than for males. So far as Massachusetts is concerned it may, therefore, be stated that during the years from 1903 to 1908 when data are available, there has been a slight increase in the classified as well as in the average wages of the wage earning groups in the population.

Turning now to the New Jersey wage statistics, we find very similar conditions. A table containing the percentages of adult males receiving certain groups of classified weekly wages in all New Jersey industries from 1897 to 1909 shows a considerable decrease in the lower groups, great uniformity in the middle groups, and a very large increase in the higher paid groups of wage earners. For example, in 1897 there were about 12 per cent. of the wage earners receiving between $15 and $20 a week, and 7 per cent. receiving $20 per week and over. In 1908 these percentages had increased to 17 per cent., and 9 per cent. Meanwhile the total number employed had increased from 41,723 to 204,782.

A very marked improvement is also shown in the wages of adult females in New Jersey. In 1897, 39 per cent. of all adult females in New Jersey received less than $5 per week. This percentage decreased regularly until in 1908 when it was 22 per cent. The percentage of women receiving between $8 and $9 has remained fairly constant, 7 per cent. in 1897 and 9 per cent. in 1908. There has been, however, a slight increase in the percentage of women receiving classified wages in all groups above $5 per week.

Here again the New Jersey figures closely parallel those for Massachusetts. In both cases the wages of adult males have apparently risen more generally than the wages of adult females, since the percentage of adult males receiving the higher rates of wages has increased much faster than the percentage of females receiving like rates of wages.

Owing to the limitations imposed by space, no analysis of wages in specific industries extending over a long period will be given. Nevertheless, a study of the representative industries of Massachusetts and New Jersey over this period shows exactly the same tendencies in the individual industries as are displayed in the industries of the state at large. In all cases, there is an upward tendency, varying slightly with the industry but always showing the same direction.

VI. Unemployment as a Factor in Wages Computations.

Thus far wage statistics have been presented, some of which do and some of which do not take into consideration the influence upon employment. Average wages, which were secured by dividing the total earned for the year by the number of persons employed, do take into consideration the unemployment factor. However, average wages are rather unsatisfactory, and as the student's chief reliance must be placed on classified wage figures, it is there that the most emphasis must be laid.

Classified wage statistics do not take into consideration the extent of unemployment. In so far as they fail to do so, they furnish a very inadequate basis for deductions as to annual earnings. It is very possible to decide from the statistics of weekly wages the relative status of the different groups of wage workers and to make comparisons between different years. But from these data alone no fair conclusions can be reached as to the annual earnings of the workers under consideration.

That unemployment is a problem of serious magnitude is clearly indicated by Dr. Devine, who states, after an analysis of the causes of destitution in five thousand New York families that unemployment affected 4,424 individuals in 69.16 per cent. of the five thousand families, while, of the twenty-five separate disabilities which led to destitution, unemployment occupies the leading place.* Unemployment (involuntary idleness during normal work time) is a prime element in creating poverty, because it is a most potent factor in lowering annual earnings. While it is impossible to state the exact extent of unemployment in the United States, a fairly accurate estimate may be based on the available unemployment data.

The English figures, excellently presented by Chapman† and Beveridge‡ are paralleled in the United States by the figures of unemployment procurable from the coal mine reports§ and the reports of the New York Bureau of Labor Statistics.‖

* Misery and Its Causes, Edward T. Devine, New York, Macmillan Company, 1909, p. 204.

† Supra, p. 316.

‡ Unemployment, W. H. Beveridge, New York, Longmans, Green & Co., Chap. 4.

§ The Production of Coal in the United States, Edward W. Parker, Washington Government Print, 1908.

‖ New York Department of Labor, Bulletin 41, p. 114.

The coal mine figures are more extensive and show that a coal miner may expect unemployment equivalent to one fourth or one third of his entire working time. In years of depression, his unemployment may increase to one half his working time.* The New York figures show a steady decrease in unemployment from 1897 to 1906, from which year there was a constant increase until March, 1907, when the unemployment for all trades was 35.7 per cent.

For the unionized trades of New York State, for the coal industry of the United States, and by inference for the other industries of the United States, we may draw these conclusions:

A. Unemployment is always a factor in modern industry.

B. The average miner can work, from year to year, about two thirds of the time.

C. In other industries, the average unemployment from year to year is almost one fifth.

D. In some years the unemployment is several times more severe than in others.†

So "The various elements in the problem lead ultimately to a degree of unemployment, varying with the year, the season of the year, and sometimes, in the case of casual labor, with the day of the week. In each case workers are without the work upon which they are dependent for a livelihood.‡

All of the statistics cited in this study must be weighed with the problem of unemployment in mind. As unemployment varies with the year and the industry, so wages for different years and different industries are modified in varying proportion by the unemployment factor.

In the reports of both Massachusetts and New Jersey some data are published regarding the number of days worked. A clear distinction should be made between this material and complete unemployment statistics which would include unemployment from personal as well as from industrial causes. Nevertheless, as the number of days worked is the only adequate basis which is afforded, it must be employed in the following discussion. In 1908, out of three hundred and five

* Unemployment in the United States, Scott Nearing, Quarterly Publications, American Statistical Association, September 1909, pp. 530–5.

† Supra, p. 539.

‡ Social Adjustment, Scott Nearing, New York, Macmillan Company, 1911, p. 276.

working days, the manufacturers of Massachusetts actually worked two hundred and seventy-five. That is, the industries of Massachusetts lost 12 per cent. of the working time. In New Jersey, during the same year, the lost working time in all industries amounted to 10 per cent. of the total working time. Thus in both states approximately one tenth of the working time was consumed in unemployment for which industrial conditions were responsible.

The unemployment varied considerably among the different industries. Among the specific industries in Massachusetts cotton goods shows unemployment of 12 per cent., foundry and machine shop of 13 per cent., boot and shoe industry, 13 per cent., and worsted industry 5 per cent. Similar variations appear in the New Jersey statistics.

The extent of unemployment over a series of years is made apparent by tables showing the total number of days worked in all industries and in specific industries for Massachusetts and New Jersey. In both cases the amount of the working time varies without any apparent uniformity. On the whole, the unemployment problem appears to be a most uncertain one, varying with the industry and the year, always prevalent, always important, caused by personal as well as industrial problems, and modifying any group of wage statistics.

VII. Earnings in Massachusetts and New Jersey.

The wage data published by Massachusetts and New Jersey are, on the whole, of a thoroughly dependable character. In the first place, the material is collected on explicit schedules which make possible the compilation of valuable tables. In the second place, this compilation has been carried forward in a scientific and thoroughly effective manner. Thus from the statistical standpoint, the data may be regarded as unusually desirable although the material is collected from the employer alone. Any deductions of wages in Massachusetts and New Jersey which are based upon the classified earnings and certain deductions which may be made from the average wage statistics are as reliable as statistical deductions may be.

The conclusions regarding average wages are important chiefly for their corroboration of the conclusions based upon

classified wage statistics and for the relation which they furnish between different years. The total average wage for all earners varies but slightly in the two states. When, however, an analysis is made of the average annual earnings by industries a somewhat greater divergence appears.

Speaking generally, $500 represents the average annual earnings of all employees in both states. This average is, however, variable, being much lower in the textile industries and much higher in the non-textile industries. Moreover, the average varies with the number of women employed. In those industries which employ many women the annual average is considerably lower than in those industries employing men exclusively.

An analysis of average wages over a series of years shows that wages vary only slightly from year to year, and that approximately the same variation occurs at the same time in the various industries and in both states. These average data are, therefore, comparative, but nevertheless give an approximate idea of the general wage conditions.

Turning now to the material furnished in the tables of classified wage statistics, one finds that the classified wages in all of the industries of both states are very similar. Thus among the adult males 52 per cent., in Massachusetts, and 57 per cent., in New Jersey, earn less than $12 per week, while 8 per cent. in Massachusetts, and 9 per cent. in New Jersey, earn more than $20 per week. Among the adult females in Massachusetts 51 per cent. and in New Jersey 60 per cent. earn less than $8 per week, while 8 per cent. in Massachusetts and 5 per cent. in New Jersey earn more than $15 per week. The divergence in the wages of females is thus somewhat greater than that in the wages of males. On the whole, however, the classified earnings of both states are very similar.

In the last chapter an attempt was made to show the importance of unemployment as a modifying force in wage statistics. The rates of wages per week are not a real indication of the annual earnings because in some industries 5 per cent. and in others 12 per cent. of the working days are lost through the slack seasons in industry. Just how extensive the loss due to sickness, accident, and other personal causes of unemploy-

ment may be, we have no means of knowing, but the reports do provide statistics which show the number of days employed during each year. If the wages per week are multiplied by fifty-two and the percentage of unemployment is deducted from the product of this multiplication, the result will be the annual earnings so far as they can be ascertained in the absence of data showing the extent of unemployment due to personal causes.

An examination of the tables shows that during the years in question when the unemployment for all industries amounted to 12 per cent. in Massachusetts and to 10 per cent. in New Jersey, wages were very considerably reduced below the rate which would prevail if the earnings per week persisted throughout the year. Thus $5 a week, or $250 a year, becomes $229, while $20 a week, $1,040 a year, becomes $915 in Massachusetts, and the like amounts become $234 and $936 in New Jersey.

An analysis of the tables shows that one tenth of the adult males earn less than $325, a year, that one half earn less than $500, three fourths less than $600, and nine tenths less than $800 per year. Among the adult females, on the other hand, one fifth earn less than $200, three fifths less than $325, and nine tenths less than $500, and nineteen twentieths less than $600 annually. While these deductions are but general, they nevertheless present in brief space the conclusions which may fairly be drawn from a study of wages in Massachusetts and New Jersey.

THE DEGREE OF CORRESPONDENCE BETWEEN TWO SERIES OF INDEX NUMBERS.

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Our present day Economics is characterized by a great use of statistics. We are no longer satisfied with mere theoretical results if statistical verification is at all possible. One feature of the increased employment of statistics is the increasing use of index numbers. Sometimes they are used as the best means for displaying the relative changes of a series of definite quantities, as in the case of index numbers for exports or imports. But perhaps their most important use is to express relative changes in complicated data, which can be shown satisfactorily by no other method. This type is illustrated by the index numbers for wages computed by Bowley and by the various well known index numbers of general prices.

A new problem arises when, having index numbers for two sets of data, we attempt to get a quantitative expression for the closeness with which variations in one series are followed or accompanied by variations in the other series. Those who desire a quantitative expression for the relationship, and are not content with graphing the two sets of index numbers and speaking in general terms of the closeness of the relationship, have usually employed the Pearsonian Coefficient of Correlation. This device has been developed in the application of statistics to biological problems.

It is the purpose of this paper to question the applicability of this correlation coefficient to problems involving two series of index numbers and to suggest a possible method for dealing with the problem. Of course, the objections brought forward have no bearing on its applicability to biological problems for which it was originally designed.

To make the criticism clear it will be necessary to explain, in some detail, how the correlation coefficient is computed. We may take the form used by Yule.* Correlation coefficient $= r = \frac{\Sigma(xy)}{N\sigma_x\sigma_y}$ where x and y represent the deviations of

* Theory *of Statistics*, 174.

corresponding terms of the two series X and Y from their respective arithmetic means; where N is the number of terms in the series; and σ_x, σ_y are the standard deviations of the two series, that is, the square root of the quotient obtained by dividing the sum of the squares of the deviations of the various items of one series from the arithmetic mean of that series by the number of items (deviation = the item − the mean). The arithmetic mean is, of course, merely the sum of the items of the series divided by the number of items. If the correlation is perfect, the coefficient has the value +1; if there is perfect negative correlation the coefficient has the value − 1. It is seen that the correlation coefficient is concerned with the admodality of the two series, that is, the manner in which the terms are grouped about the means of the series.

One objection may now be stated. We have seen that index numbers give us relative changes and that when we compare two series we are interested in seeing how the changes in one series correspond to changes in the other, but the correlation coefficient takes no account of the order in which the items of the series occur. The two series

100	80	and	100	80
75	95		130	55
130	55		75	95
90	120		90	120

would have the same correlation coefficient, though in the first case an increase or decrease of the one set is always accompanied by the reverse in the other, and in the second case in one instance there is an increase in both sets of numbers. There are six possible orders in which the above four pairs of numbers may be arranged (irrespective of the pair which is taken to start with). Of these six, two orders give for every increase or decrease of one series the reverse in the other. In four orders there is one case each in which an increase or decrease in one series is accompanied by an increase or decrease in the other. The formula for the correlation coefficient considers the relation of the various pairs of values in the series to their respective means but not at all their relation to the pairs of values which precede or follow them. Since the relation of the pairs of numbers to those nearest them is the significant thing in dealing with

index numbers and since the correlation coefficient is not affected by changes in this relationship, the correlation coefficient does not appear to be a good means for showing the degree of relationship between two sets of index numbers. In many cases the series of index numbers refer to various periods of time. The above objection is equivalent to saying that the correlation coefficient disregards the time element altogether.*

In order to make clear the next objection it will be necessary to examine some of the curious algebraic properties of the correlation coefficient. The first property is that the correlation coefficient of two series of index numbers is not changed if we add a constant to each term of one series. The reason is simple. If we add a constant k to each term of the series, the mean of the series will be increased by k. The standard deviation will not be changed. Each term and also the mean has been increased by k, so the difference between them will remain the same. By exactly the same reasoning the xy will not be changed, since x represents the difference between the term and the mean. Of course, we have not changed the number of terms, N. So there is no change whatever in the formula when we add a constant to each term of one series. Analogous reasoning would show that we may substract a constant from each of the terms of one series without changing the value of the correlation coefficient. It is also obvious that we may add or substract a constant (not necessarily the same one) to or from both series of numbers without changing the value of the correlation coefficient.

The second algebraic property of the correlation coefficient to be noted is that we may multiply each term of one of the series by the same number without changing the value of the correlation coefficient. Suppose we multiply each term by l; then the mean will be l times the former mean. Both the mean and the terms will be l times what they were formerly and so their differences will be l times the former difference. When the differences are squared, we will have l^2 times the former differences squared. Taking the sum of the squares of the deviations of the various terms and divid-

* Cf., Fisher, *Purchasing Power of Money*, p. 279.

ing by the number of terms and then extracting the square-root, our new standard deviation will be l times the former one. The x's in the numerator of the formula of the correlation coefficient, which represent the deviations from the mean will now all be multiplied by l since both the mean and the terms are l times their former value. Each being l times the former value, the sum will be l times the former sum. The result, then, of multiplying each term of the series by l is to multiply both numerator and denominator of the fraction which is the correlation coefficient by l. The l's may be cancelled and so the value of the correlation coefficient is not changed. It is obvious that we may multiply each of the two series by a constant multiplier (not necessarily the same) without changing the value of the correlation coefficient. Having examined these algebraic properties of the correlation coefficient, we shall now see how they affect its applicability to the problem of the relationship of two series of index numbers.

The possibility of multiplying either or both series by some multiplier without changing the value of the correlation coefficient, is evidently a point in its favor. It will be remembered that our index numbers are merely relative. The ratio of the quantity in one year to that of the next year is given by the ratio of the index number of the first year to the index number of the second year. Suppose the index number is for Imports into the United States, we may express it as follows: $\frac{\text{Imports } 1855}{\text{Imports } 1860} = \frac{100}{137.2}$. It is evident that multiplying each of the index numbers, e. g., by 2, will leave the value of the ratio the same. If then the new series expresses the same relations as before, the correlation coefficient with some other series should remain the same.

The fact, however, that a given quantity may be added to or substracted from the terms of our series without changing the value of the correlation coefficient, is perhaps the strongest argument against using it for testing the relationship between two sets of index numbers; for when the same number is added to each of a series of index numbers, they no longer express the same relations. This proposition may be made clear by a

simple example. If there is a series of index numbers 50, 60, 80, the ratio of the first to the second term is 5 to 6 and of the second to the third term, 3 to 4. Now if 100 be added to each term the series becomes, 150, 160, 180. Here the ratio of the first to the second term is 15 to 16 and of the second to the third term, 8 to 9. It is seen that the ratios between the terms are entirely changed. The objection then is plain. The correlation coefficient would show that these two series were perfectly correlated, while as a matter of fact they do not show the same relative changes. Various combinations of adding a constant or multiplying by a constant might be made. The correlation as found by the correlation coefficient is perfect for the following sets of numbers:

110	150
160	225
130	180
120	165

The relation may not be evident at first, but it will be discovered that in each case the term of the second series is $\frac{3}{2}$ of ten less than the corresponding term of the first series. The situation, then, is that the correlation coefficient will indicate perfect correlation between two sets of index numbers if they show the same relative changes, but when the correlation coefficient indicates perfect correlation, the two series may not show the same relative changes at all. Surely this uncertainty is an indication of the unfitness of the correlation coefficient to test the relationship between two sets of index numbers. A chemical test would not be considered of great value which always indicated the presence of an element but also gave the same reaction in other cases when the element was not present.

Our objections to the Pearsonian Correlation Coefficient as a means of testing the relationship between two series of index numbers are, to sum up: (1) it entirely disregards the element of time which in most problems in which index numbers are used, is of prime importance; and (2) the result obtained is not definite, if the relative changes are the same we get perfect correlation, but perfect correlation does not always mean that the relative changes are the same. It may be well to repeat that these objections apply only to the use of the

correlation coefficient in connection with index numbers and not at all to the general use and especially not to its use in Biology.

Having brought forward these objections to the use of the correlation coefficient as a means of showing the relationship between two series of index numbers, it may be well to suggest a better means. We may indicate the way a figure can be found for the closeness of the relationship between two series of index numbers. This figure may be called the Degree of Correspondence to avoid the confusion of using the term correlation coefficient for what is obtained in another way. We assume that we have two series of index numbers which represent the relative changes in two sets of data, usually for a series of years. We are interested in finding out whether an increase or decrease in one is associated with a like change in the other. If this be the case we say there is positive correspondence. If they both increase or decrease in the same ratio, there is perfect positive correspondence. If one increases and the other decreases there is negative correspondence. If the one increases in the same ratio as the other decreases, there is perfect negative correspondence. If one changes and the other remains constant, there is no, or zero, correspondence.

With these things understood, we may figure the degree of correspondence in two ways. First, roughly, we may examine our series and for every case of positive correspondence we put down a +1 and for every case of negative correspondence, a −1 and for every case where one is constant while the other changes, a 0. Then the arithmetic mean of these numbers may be taken as the rough value of the degree of correspondence between the two series. It is evident that the figure may vary from +1, which would indicate perfect positive correspondence (considering only the direction of the change, not the amount) to −1, which would be perfect negative correspondence (of direction of change). The case where there is an equal number of +1's and −1's and so the degree of correspondence would be 0, is of interest. In many arguments where the method here suggested has been practically used, however, (the number of agreements and disagreements is

usually pointed out) it has been held that some relationship is shown if half of the cases are agreements. Yet, if there were but two options and the series were totally unrelated, mere chance would give approximately half agreements and half disagreements, the nearness of the approximation depending upon the number of cases considered. It is evident that in talking of correspondence we wish to imply something more than what might be the result of chance.

Second, we may get a more accurate form of the degree of correspondence. To obtain this it is necessary to substitute for the +1 or −1 as used in the rough method a more exact expression. The following procedure may be adopted. We are dealing, of course, with pairs of index numbers. By multiplying one or both pairs by factors we do not change the relations expressed but we may make the first numbers of the two pairs agree. Next we may get the amount of change in each case and take as the degree of correspondence the fraction which has the smaller change for the numerator and the larger change for the denominator. An example will serve to make the process plain. We start with a part of a table of index numbers which is as follows: $\begin{matrix}60 & 50\\ 72 & 55\end{matrix}$. The first step is to make the first two numbers agree. We may do this either by multiplying each term of the second set by $\frac{6}{5}$ thus giving $\begin{matrix}60 & 60\\ 72 & 66\end{matrix}$ or by multiplying each term of the first set by $\frac{5}{6}$ thus getting $\begin{matrix}50 & 50\\ 60 & 55\end{matrix}$. The degree of correspondence would then be $+\frac{1}{2}$ ($\frac{6}{12}$ in the first case, $\frac{5}{10}$ in the second case). The sign is plus because the changes are in the same direction. If we had $\begin{matrix}50 & 50\\ 60 & 35\end{matrix}$, the degree of correspondence would be $-\frac{10}{15}$ or, reducing, $-\frac{2}{3}$. The sign is minus because the changes are in opposite directions. By treating each successive change in this manner and then taking the arithmetic mean of the results we obtain what may be called the Degree of Correspondence in the more accurate form. In brief, the suggested Degree of Correspondence is the average correspondence

(computed in the manner suggested above) shown by successive terms of two series of index numbers.

One example of the application of the proposed Degree of Correspondence may be given. Irving Fisher has attempted a statistical proof of the quantity theory of money. He gives* two series of index numbers for the years 1896 to 1909. Both series represent price changes;. one is obtained directly from price statistics and the other is obtained indirectly by solving the equation of exchange for the price level. Fisher does not consider the Pearsonian Correlation Coefficient satisfactory, but he finds the value of it for his figures because it has been used to test previous attempts at statistical verification of the quantity theory of money. Applying it in two different ways he gets correlations of +.97 and +.57.† He prefers the latter figure. Below is given the application of the proposed method.

Year.	Index Numbers of Prices.		Degree of Correspondence.		
	Direct.	Indirect.	Positive.	Zero.	Negative.
1896	63	54	...	..	.43
1897	64	52	...	..	...
1898	66	56	.41	..	...
1899	74	69	.52	..	...
1900	80	68	...	..	.18
1901	84	76	.43	..	...
1902	89	82	.75	..	...
1903	87	75	.26	..	...
1904	85	81	...	..	.29
1905	91	83	.35	..	...
1906	97	90	.78	..	...
1907	97	86	...	0	...
1908	92	87	...	..	.23
1909	100	100	.58	..	...
			+4.08		−1.13=2.95+13=+.23

The degree of correspondence is then +.23. The degree of correspondence between the series obtained by taking alternate years is much higher. If we start with the first year, it is +.67; if we start with the second year, it is +.34. If we take merely the first and last terms of the series, the degree of correspondence is +.69.

* *Purchasing Power of Money* p. 293.

† *Ibid*, pp. 294-5.

NOTES AND REVIEWS.

STATISTICS AT INTERNATIONAL CONGRESSES ON HYGIENE AND DEMOGRAPHY.

Historical Note on its Organization.

The Fifteenth International Congress on Hygiene and Demography will meet in Washington September 23–28, 1912, on the invitation of the Congress and under the honorary presidency of the President of the United States. It is the first time that this Congress has met in the United States, or, indeed, anywhere outside of Europe. In view of that fact it may be a service to some members of our Association to sketch the history of this form of international organization.

These Congresses have had little connection one with another and in the past there has been some uncertainty regarding the number which have been held. In connection with the Congress held at Brussels in 1903, the history of past Congresses was reviewed and corrected. At its inception the Brussels Congress was numbered as the eleventh, but before its close two somewhat irregular Congresses were added to the list; viz., the Brussels Congress of 1852 and the Paris Congress of 1889. The revised list shows that the first of these International Congresses was held a year earlier than the first International Statistical Congress, which assembled at Brussels in 1853.

These Congresses, it might appear, are the earliest international gatherings having anything to do with statistics. Such a statement, however, would be misleading unless explained. The Brussels Congress of 1852 was called "The General Congress of Hygiene." Neither in its title nor in its proceedings is there any indication that statistics, as the handmaiden of public health, was included among the subjects of discussion. The second in the series of these International Congresses was held in the same city (Brussels) 24 years later under the title "International Congress of Hygiene, Safety and Social Economy." It convened in connection with an International Exposition of Hygiene and Life Saving Appliances. In the organization of this Congress likewise the subject of statistics or demography was not recognized, but under the heading of "Medical Hygiene" much attention was given to the subjects of infant mortality and occupational mortality. In connection with these discussions the word *Demography*, then a recent French coinage, was freely used, and in several of the papers and much of the discussion the statistical method was illustrated. This second Brussels Congress really began the series, for since its meeting in 1876 similar congresses have been regularly held at intervals of from two to five years. The third Congress was held at Paris in 1878, also in connection with the International Exposition of that year, but with a briefer title, "The International Congress of Hygiene." At this Congress for the first time American delegates were present. They represented the Sanitary Commission

of New York, the American Medical Association, the Technological Society of Kentucky, and the Medical Society of the same state. Demography was not formally recognized in the organization of its sections, but the statistical method was freely employed by those who took part in the discussions.

During the interval between the first of these International Congresses of Hygiene in 1852 and the third in 1878 a series of nine International Statistical Congresses had been held, the first at Brussels in 1853, the last at Budapest in 1876. These were the earliest and during the third quarter of the nineteenth century they were the only form of international statistical gatherings. Before 1850 various countries had created statistical offices which were grappling independently with similar difficulties. The idea of a statistical congress seems to have been expressed first by Quetelet of Belgium while he was attending the London Exposition of 1851. He talked then with various English statisticians about the need for such a gathering and his spirit and purpose dominated the series. Through these Congresses he sought to secure or to pave the way for securing uniform and comparable data from all the civilized countries. For such a purpose small gatherings of official statisticians and of others who made statistics their life work would have been best. As a matter of fact, membership was open to any person interested in the subjects discussed. They were attended not by scores but by hundreds, the average enrollment being 471 and the maximum—that at the Florence meeting—being 731, of whom a large majority had no official connection with statistics.

The organization proving thus ill-adapted to the main purpose in view, efforts were made, beginning at the London Congress of 1860, to correct the initial error by holding in connection with the Congress another gathering to which only official delegates were admitted. As this idea gained favor there was organized in 1872 in connection with the St. Petersburg Congress a Permanent International Commission. Unfortunately this Commission was badly planned. Membership was conferred not upon professional statisticians, but upon all those who were coöperating in the preparation of a plan for international statistics and in working out various parts of that projected work. This Permanent Commission met for the fourth time at Paris in 1878 and there an effort was made to reorganize and readjust it. For reasons that are irrelevant to the present subject, the effort resulted in failure. The President of the Permanent Commission resigned and no more meetings of that Commission or of the International Statistical Congress, to which it was a pendant, were held.

While these Statistical Congresses were drawing to a close, an independent effort to develop international statistics was made by Dr. Arthur Chervin of Paris, Editor of *Annales de Démographie internationale*. He proposed that an International Congress of Demography should convene on the occasion of the Paris Exposition of 1878 and secured the influential coöperation of Professors Émile Levasseur and L.-A. Bertillon. The meeting was held just before the Paris session of the Permanent Commission of the International Statistical Congress and in this way the attendance of a

large number of prominent and representative statisticians was secured. Before they adjourned a Permanent Demographic Commission, consisting of Messrs. Bertillon of France, Bodio of Italy, Finkelnburg of Germany, Janssens of Belgium and Kummer of Switzerland, was organized and authorized to decide upon a time and place at which a second International Congress of Demography should be held.

In 1880 an International Congress of Hygiene, then called the third but now known as the fourth, was held at Turin. This Congress like its predecessors, I believe, paid no attention to demography. In 1882 what is now called the fifth Congress was held at Geneva under the title which has been used ever since, "International Congress of Hygiene and Demography." In opening the fifth section, entitled "Demography," Doctor Kummer, Director of the Swiss Federal Bureau of Statistics, referred to the Permanent Commission, of which he was a member, and indicated that the decision to meet in conjunction with the Congress of Hygiene had been made by the Commission. He addressed the section not as a section, but as itself the second International Congress of Demography. At this meeting a committee was appointed to consider the question whether future Demographic Congresses should or should not meet separately. Later this committee reported through Dr. Jacques Bertillon, who presented the opinions of the majority and the minority. The majority pointed out that for several years no International Statistical Congresses and no meetings of the Permanent Commission had been held and that the reasons against such meetings still subsisted. They urged that a separate Congress of Demography would probably lack official support and without such support official statisticians could not attend. Admitting the success of the Congress at Paris in 1878, they said that it was because the International Exposition and the Permanent Commission of the International Statistical Congress met then and there. They pointed out further that the efforts of M. Janssens to secure a second Congress of Demography at Brussels in 1880 had been fruitless and had revealed the difficulties in the way of continuing the series. After discussion, it was voted on the motion of M. Körösi that a Permanent Commission should be appointed and charged with the duty of arranging for the next meeting of the Demographic Congress and that this Congress should meet in connection with the International Congress of Hygiene unless the interests of demography called for an independent session.

The sixth Congress met at The Hague in 1884 and at the opening meeting of the fifth section, on Demography, the President of the section M. A. Beaujon said that he had the honor "of opening the third session of the Demographic Congress. The *Annals of International Demography*, edited by our colleague, Dr. J. Bertillon, in reporting the last Congress, have said that to give the name of *Congress* to this gathering, which sheltered itself under the aegis of a larger, if not more important Congress, was to use perhaps an ambitious term. But ambition is not a fault and besides our honored colleague, Doctor Kummer, when he opened the second Congress of Demography at Geneva could justify that term by referring

to the origin of the meeting, which in truth was only a continuation of the Paris Congress of 1878. The conditions of our organization have not changed since the meeting at Geneva and, if we *were* a Congress, we *are* so still, notwithstanding the small number of experts whom I have the honor to address."

To this Congress three delegates were accredited by the government of the United States; namely, Dr. J. S. Billings from the War Department, Dr. J. M. Browne and Dr. J. R. Tryon from the Navy Department.

The seventh Congress met at Vienna in 1887 and the fifth section, demography, was opened by its president, Inama-Sternegg, in the following words: "In the name of the Permanent Commission created by the third International Congress at The Hague I hereby open the fourth Demographic Congress. Like its predecessors at Geneva and The Hague this is organized as a section of the International Congress of Hygiene and Demography."

What is now known as the eighth Congress was held at Paris in 1889 in connection with the International Exposition of that year and there is no evidence that demography was then treated as a quasi-independent branch. The same is true of the meeting at London in 1891.

The Congress at Budapest in 1894 organized the division of demography, with Professor Dr. Louis Lang as president, into seven sections: I. Historical demography with Béla Földes as president; II. General demography with Lang as president; III. Methods of demography with Jekelfalussy as president; IV. Agricultural demography with Vargha as president; V. Demography of industrial workers with Matlekovics as president; VI. Demography of great cities with Körösi as president; VII. Physical and mental defects with Laufenauer as president.

The Congress at Madrid in 1898 likewise organized demography into sections: I. Technique; II. Results; III. Dynamic demography.

The Congress at Paris 1900 had only one section of demography, presided over by Levasseur. Those at Brussels in 1903 under the presidency of Maurice Sauveur and at Berlin in 1907 under the presidency of van der Borght were also in only one section.

Since 1885 two independent series of international statistical gatherings have been held, the International Statistical Institute organized in that year, composed of a small and strictly limited number of statistical experts meeting every other year and continuing under better auspices the traditions of the defunct Permanent International Commission of the International Statistical Congress, and the International Congress of Hygiene and Demography, meeting at intervals of two to five years and continuing the traditions of the International Statistical Congresses.

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SALESWOMEN IN MERCANTILE STORES.

SALESWOMEN IN MERCANTILE STORES. ELIZABETH BEARDSLEY BUTLER. CHARITIES PUBLICATION COMMITTEE. NEW YORK, 1912. CLOTH, $1.08; PAPER, $.75, PREPAID.

Three years ago, at the invitation of the Consumers' League of Maryland, the Russell Sage Foundation made an investigation of the employment of saleswomen in mercantile establishments in Baltimore. Though belated in its appearance and dealing with special conditions in a single city, the report is nevertheless of value as representing what is largely true in mercantile life at the present time.

This investigation was conducted by Miss Elizabeth B. Butler, who had previously made a study, for the Pittsburg Survey, of the working conditions of women in Pittsburg, under the title of "Women and the Trades."

The study made in Baltimore, which included all stores having seven or more female employees, dealt with thirty-four establishments in which were employed four thousand girls and women. Some of these stores were conducted in old buildings and under adverse conditions.

In the preface the purpose and scope of the volume are briefly stated:— "It is hoped that the volume will enable the public as well as employers in Baltimore to understand local working conditions better and lead them to give more thoughtful attention to questions affecting employees and store management; it will be suggestive to other cities, and is an example of fair and careful work which should be imitated elsewhere. Sweeping conclusions must not, however, be rashly drawn from so limited a study. For a wider view the interesting volume entitled 'Wage-Earning Women in Stores and Factories' recently issued by the United States Department of Commerce and Labor should be consulted. This gives in more condensed form facts gathered in various cities."

The investigator spent months in a personal study of the stores, observing all features of employment, the plans and methods of store management, and the attitude and experiences of employees. Cards of investigation were used and results were tabulated.

It was found that of the persons employed 68.57 per cent. were girls and women, and 31.41 per cent., boys and men. These figures agree very closely with those obtained in the local studies recently made by the Vocation Bureau of Boston and seem to indicate the relative numbers found in general at the present time in establishments where women may be employed behind the counter. The superior qualities of women for this kind of service, their tact, perception, patience, attractiveness, and special aptitude for selling many kinds of goods have fixed their place in what is probably a permanent proportion. Certain work belongs distinctively to men, and they appear to be holding their relative proportion.

Saleswomen constituted 54.78 per cent. of women employees, and buyers 1.67 per cent.

Particular attention was given to heating, lighting, ventilation, the provision of seats for saleswomen, and the steps taken for their welfare generally. Lines of advancement for women are clearly indicated.

The results in the matter of hours of labor are interesting. Instead of a 54 hour week, the highest claimed by any one of the thirty-four stores, the actual range was from 51 hours to 59; and in the holiday season the variation was from 60 to 80 hours. It is evident that at the time of the investigation there was little enforcement of labor regulations in the City of Baltimore. In few cases were there shifts of help; in most, girls and women served through the lengthened day. In numbers employed seasonal changes produced a variation of 36 per cent., which is generally true in mercantile establishments.

Perhaps the most vital feature of the study made is that of wages. The weekly wage limits were $2.00 and $25.00. Of the 4000 female employees considered, 350 received $3.00 or less; 750, from $3.00 to $4.00; 450, from $4.00 to $5.00; 600, from $5.00 to $6.00; 1100, from $6.00 to $7.00; 300, from $7.00 to $8.00; and so on in rapidly decreasing numbers. From $6.00 to $7.00 appears to be the wage of much the largest division of women employed in mercantile establishments. This, also, has been verified by other agencies in research work.

This work relates to a single community, but its value is enhanced by the fact that it is an intensive study, while by comparison and correlation of this and other similar investigations we may obtain valuable light upon the employment conditions of the saleswomen, and of women in mercantile employment.

The study is welcome at this time as a contribution to vocational guidance and to general industrial betterment.

FREDERICK J. ALLEN, of the Vocation Bureau, of Boston.

RECENT FOREIGN STATISTICAL PUBLICATIONS.*

Algeria. Bureau de la Statistique Général. Tableau général des communes de l'Algérie.

Argentine Republic.

Buenos Aires. Municipal statistics. Monthly Bulletins 1 and 2, January and February, 1912.

Rosario de Santa Fé. Municipal statistics. Monthly Bulletin, March, 1912.

Australia. Royal Commission on Insurance, Report.

Part I —Life Assurance, 1909.

Part II—Fire Insurance, 1910.

Census Bulletins.

1. Population of states and territories.
2. Persons of non-European races.
3. Ages.
4. Population of counties, local government areas, etc.
5. Population of Commonwealth electoral districts and provinces.
6. Birthplaces.
7. Length of residence in Australia.
8. Religions.

Austria.

Cracow. Bulletin Mensuel de Statistique Municipal pour Fevrier, 1912.

Belgium. Liège, Bureau de L'Etat Civil Bulletins Hebdomadaires, pour Avril 6, 13 et 20, Mai 4 et 11, 1912.

Bulyaria. Direction Général de la Statistique, Bulletin Mensuel, 5–mo Année, Avril, 1912.

Mouvement commercial de la Bulgarie avec les pays étrangers, pendant le III trimètre, 1911.

Canada. Department of Labour, Report on Labou Organization in Canada, 1911.

Census and Statistics Office, Census and Statistics Monthly, No. 47, April, 1912.

Department of Customs, Unrevised Monthly Statement, March, 1912.

Ontario (Province). Department of Labour—Twelfth Annual Report, 1911.

St. Lucia. Governor Report, 1910.

St. Vincent. Governor Report, 1910–11.

Leeward Islands. Governor Report, 1910–11.

*Received by the U. S. Bureau of the Census from April 15 to May 31, 1912.

Germany.

Cologne. Die Arbeitslosenzählungen, vom 17. Juli, 1910, und 22. Januar, 1912.

Königsberg. Statistisches Amt.
Monatsberichte, Januar, Februar, and März, 1912.

Prussia. Statistisches Landesamt.
Zeitschrift, 1911, 1–4.

Bavaria. Statistisches Landesamt.
Zeitschrift, 1912, 1–3.

Posen. Statistisches Amt. Die Wohnungsverhältnisse, 1910.

Schöneberg. Statistisches Amt. Vierteljarfsberichte, Drittes und Viertes Heft, 1911.

Chemnitz. Statistisches Amt. Monatliche Mitteilungen, February, March, April, 1912.

Kaiserliches Gesundheitsamt, Medicinal Statistische Mitteilungen, XIV Band, Heft 3, 1911.

General Kommission der Gewerkschaften Deutschlands, Correspondenzblatt, 27 April, 1912.

Bremen. Statistisches Amt. Monatliche Berichte, Februar, 1912.

Great Britain.

England. Registrar General, Weekly Returns of Births and Deaths in London and in 94 other great towns, April 27, May 4, 11 and 25, 1912.

Board of Trade—Returns relating to the Railways of the United Kingdom, 1911.

Liverpool Cotton Assoacition, Weekly circular, May 3, 1912.

Salford, Medical Office of Health, Bulletin, First Quarter, of 1912.

Scotland. Registrar General, Monthly returns of births, deaths, and marriages, April 1912.

Census of Scotland, 1911.
Vol. I, Part 1, City of Edinburgh.
Vol. I, Part 2, City of Glasgow.
" Part 3, City of Dundee.
" Part 4, City of Aberdeen.
" Part 5, County of Aberdeen.

India. Commercial Intelligence Department.
Agricultural Statistics of India, Volume II (Native states).
Statistics of Cotton Spinning and Weaving in the Indian Mills, February, 1912.
The Agricultural Ledger, No. 4, 1911.

Ireland. Census, 1911. Preliminary report.

Italy. Direzione Generale della Statistica e del Lavoro, Annuario Statistico Italiano, Seconda Serie, 1911, Vol. I.

Commissarieto dell' Emigrazione. Bolletino dell' Emigrazione, Anno, 1912, No. 1.

Florence. Officio di Statistica, La mortalita per Tubercolosi a Firenza nel Quinquennio, 1907–1911.

Mexico.

Pueblo. Secion de Estadistica, Boletin de Estadistica, April, 1912.

Netherlands. Bureau Central de Statistique—Maandschrift, No. 3 and 4, 1912.

Newfoundland. Colonial Secretary

St. John Lunatic Asylum, Report, 1911.

St. John Poor Asylum, Report, 1911.

St. John Public Schools under Catholic Boards, Report, 1911.

St. John Public Schools under Salvation Army Boards, Report, 1911.

Russia.

St. Petersburg. Bureau de Statistique, Bulletin Hebdomadaire 13 and 20 Avril 4, and 18 Mai, 1912.

Bureau of the General Director of Agriculture, Bulletins 4, 5, and 6, 1911.

Moscow. Bureau Statistique, Décès dans la ville de Moscou (weekly) 1912.

Société Imperiale Libre Economique, Travaux No. 4, 5, et 6, 1911.

Straits Settlement. Colonial Secretary, Annual Departmental Reports, 1910.

Sweden. Bureau de Statisque, Statistisk Manadsskrift, January, February, and March, 1912.

Switzerland. Schweitzerische Statistik, Ergebnisse der Eidgenossischen Betriebszählung vom 9. August, 1905, Band 2 und 3.

Transvaal.

Johannesburg. The Town Clerk, Municipal Statistics, 1912.

Uruguay.

Montevideo. Boletin de Estadistica Municipal, 1912.

Venezuela. Ministerio de Fomento, Bulletins December, 1911, January and February, 1912.